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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—
- The Results at Savannah..... 577
- Applications for Space, World's Fair..... 578
- Briefly Told..... 578
  Notes.
- Fireproofing Exterior Surfaces..... 578
- Inaugural Address, North of England Gas Managers' Association... 579
- *Analyses of Flue Gases from Steam and other Boilers..... 581
- A Point of Interest to Gas Managers..... 582
- Domestic Electric Lighting..... 584
- Special English Correspondence..... 585
  Prepayment Meters—Bricks Boiled in Tar—A Curious Accident—Coal Gas and its Rivals.
- Some Practical Hints on Lubrication..... 586
- Natural Gas Companies and Their Reported Profits..... 586

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 587
Personal—Purchase of the Badger Illuminating Company—A Commonsense Circular—Illinois Fuel Gas and Ice Company—Troubles of the Kentucky Rock Gas Company—Annual Election, Conshohocken, Pa.—Death of Mr. Geo. Kendall—Probable Sale of the Galena (Ills.) Works—Gas Works for Marshall, Minn.—Cheaper Gas for Hannibal, Mo.—The Consolidation at Worcester, Mass—Councilman Humphreys' Estimate of the Cost—Annual Meeting, Milford, Mass.—Bankrupt—Wedding Bells—Public Lighting, Toronto—Leaves from the History of the Jacksonville (Ills.) Company—And Many Other Items.

- Progress of the Gas Engine..... 589
- Gas and Vapor Burners..... 589
- The Market for Gas Securities..... 590

THE RESULTS AT SAVANNAH.

We fear that what we have to say in this issue respecting the meeting in Savannah of the American Gas Light Association will savor somewhat of the flavor of the nut that even now is being gathered in by the small boy. Even so, however, we may take heart of hope in the knowledge that that which is seasonable is not out of date, and accordingly we will endeavor to supplement "Three Stars'" telegraphic correspondence of a week ago with some further account of the gathering at Savannah. In the first place, the weather was of the true Southern type, the first day being in every sense a royal one, and the second was bearable, provided one could always enjoy a siesta on the grand verandahs of the De Soto. Mention of the latter leads to the remark that Savannah and the South have every reason to pride themselves over this notable addition to their many well-equipped and ably-managed hostelries.

The attendance was gratifyingly large, and, strange to say, the Eastern contingent favored the sea route, a large party having intrusted themselves to the care of the rovers of the ocean. Nor was that confidence misplaced, because the same route and methods homeward were chosen. It is whispered that some cases of "malaria" were reported on the home trip, but Hatteras has fewer terrors now for many than was the case before. The attendance was a representative one also, as may be judged from the fact that Quebec to the east and north and California on the west joined in replying to the roll call. Neither can we omit a reference to the presence of one of the veterans, whose appearance was the signal for a genuine ovation, the ring of which was loud and long when Mr. Samuel Prichitt came upon the scene. Another rare bird was winged in the person of Mr. J. B. Crockett, the President-Engineer of the San Francisco Company. But an attempt to name all the notables present would be too telling on our space; suffice it to say that a goodly percentage of the Association was represented, and that the representation was there for business. The absent ones, however, were inquired after with solicitude. Where was Down? Where was White? Where was Perkins? And so it went. The fair sex were on hand in goodly numbers, and their Southern sisters were so on kindness bent that many pleasant and enduring acquaintanceships have been formed. These fair matrons and maids are wondrous entertainers.

The opening proceedings on the first day, which were conducted in the banquet hall of the De Soto, were memorable in that Mayor Schwarz, the Board of Aldermen and other city officials, in words that were full of welcome and hospitality, received the Association and offered to them the "freedom of the city." The experience was a novel and pleasing one, and was heartily appreciated. With McMillin in the chair and Humphreys at the desk—both veterans in the art of guiding assemblies easily and with precision in the course that expedites the objects of such gatherings—the convention went right at the programme before it. The report of the Council, we are sorry to say, shows that some of the past actions of the Association are now bearing their natural fruit. It is quite an easy matter to dispose of a surplus; in fact far easier than it is to accumulate such a useful adjunct. But as we may best learn how to guide ourselves safely in the future by carefully remembering the missteps of the past, perhaps it is safe to say that it is a case of "all's well

that ends well." Meanness is not economy; but, on the other hand, neither is profuseness well regulated liberality. Still, as this is closely connected with the domestic policy of the Association, and as even mild criticism of that policy has hitherto been received in a manner well-calculated to chill the ardor of the critic, it may be just as well to draw the curtain down, permitting the figures of the "balance" to speak as they only can.

Mention of the Treasurer brings to mind one very unpleasant resolution of his, and that is his announcement that this is the last year which he will consent to remain in the office of Secretary and Treasurer. To say that we regret this determination is to put it very mildly. Mr. Humphreys has been an invaluable man to the Association. He gave it freely of his time and talent, and while we do not say that he cannot be replaced, we do unhesitatingly say that no successor that can be named will ever excel the record that stands behind him. Careful, conscientious, methodical and successful, his administration of the dual office, with all its wearisome routine, must elicit the admiration of all. We earnestly hope that his determination is not irrevocable, and that 1892 will find him still in charge.

President McMillin was in all respects an admirable presiding officer—cool and quick, his grasp of law was rigid and his interpretation of it just. This brings us to his address, which, as a whole, would seem to us to be clearly indicative of the peaceful and united condition of our industry at the present day. No new topic is therein discussed, simply because nothing new has crossed the gas maker's horizon in the limit of the twelvemonth. The questions that were uppermost in 1889 are those that hold the floor in 1890. Of these questions, perhaps that of municipal control and operation of gas and electric lighting plants is the one which most appeals to the craft. The Nationalistic movement seems to have gathered additional impetus of late, but that it is to be feared greatly by the manufacturers of artificial light we do not believe. While some cities are agitating in favor of municipal control, it is odd to see the finger of futurity pointing the reverse way in respect to one or more places in which municipal control is almost as old as the hills. It does not require any very great amount of perception, from scanning the signs of the times, to cause one to lean to the view that municipal control in Philadelphia is tottering in the balance, and that Richmond also wavers. Should Philadelphia finally agree that private ownership would serve her interests, in respect to gas lighting supply, better than municipal control, the Nationalist movement would receive a severe setback, if not a permanent one. Nevertheless, it may be well not to wait too long for practical exemplification of the Philadelphia or other instances, wherefore unity of movement in appealing to State legislatures ought not be delayed. If President McMillin points out the danger, he also, and with simplicity, points to the cure. Massachusetts has shown that State Commissions can be relied on to be just, and what has been done in Massachusetts can be achieved elsewhere. On the subject of fuel gas Mr. McMillin can speak by the card. St. Louis has, in a measure, at any rate, vetoed the belief that there is profit in distributing a distinctively fuel gas to ordinary consumers, and the very same city has also shown that illuminating gas will be accepted with favor by the people as a fuel gas in their kitchens. Take it all in all, Mr. McMillin's address can be read with pleasure and profit. We hoped to print it (in connection with other matter that preceded it on the first day of the convention) in this issue of the JOURNAL, but a change seems to have followed the desire of a year or so ago that the proceedings should be printed with all possible haste after the adjournment of the meeting. It is now virtually agreed on that the old plan of having the proceedings thoroughly edited before publication shall be the order, and we (consistently with our former opinion) heartily agree in the determination. However, our readers may rest assured that the proceedings will be in their hands as soon as we have the matter to print.

The paper list this time was a most excellent one. Ten subjects were discussed, and the authors treated their subjects sensiby and cleverly. From the Secretary's advance notices we were reasonably sure of nine contributions, and the promised ones were duly presented. A tenth one came to hand, the author being that energetic Southerner, Mr. Arthur E. Boardman, who contributed a most interesting lot of "Hints on Electric Lighting by Small Gas Companies." It is a decidedly pleasing knowledge to have that at one meeting no less than ten widely-varying themes are put before the members, in the shape of ten well-prepared articles—all related to the business of the craft. A dozen years ago the prospect of such a thing was rather remote; all of which goes to show that our Engineers and Superintendents—the men upon whom the capitalists that are financially interested in the gas undertakings of America are dependent for their dividends—are abreast of the day and time. No one can gainsay that gratifying fact. With every meeting this becomes all the more pronounced. The papers bear the impress of thought and study, and the seal of worth and usefulness.

The social side of the convention was in all respects flawless. The arrangements were made with care and carried out with discretion, certainty and hospitality. No lagging, no shirking, no forgetting. The local hosts—the United Gas Improvement Company and the Mutual Gas Light Company—left nothing undone to secure the comfort of and to administer to the pleasure of their guests. The banquet was one of those rare affairs where beauty and elegance were coupled with plenty and hospitality, while harmony and wit were the impulses that marl ed its course. And if this is to be the last formal banquet that will be accepted by the Association, it can only be said that the custom had a glorious ending.

The third day, as to the outing time, was but a fitting sequel to the days that preceded it. The cotton press, the Tybee, and many other things worth seeing and remembering, in and around the beautiful city, commanded the close attention of the visitors, albeit some elected to wander into Florida on an "independent outing" that was also thoroughly enjoyed by the roving spirits who engineered it. In every sense the Eighteenth Annual was a most enjoyable convention, and not one who participated in its lessons and pleasures can fail to have returned to his post of duty better fitted both in mind and body to carry on the task of lighting the way.

APPLICATION FOR SPACE, WORLD'S FAIR.

Mr. John P. Harbison, of the Committee on World's Fair, of the American Association, desires us to say that the Committee is ready to receive applications from intending exhibitors in the gas department of the coming "World's Fair." A hint to that effect would hardly seem necessary, but it would be well, nevertheless, to bear in mind that those who apply first shall be served first. The applications should be made to Secretary C. J. R. Humphreys, at Lawrence, Mass. We hope and fully expect that every one of our advertisers will appreciate the necessity of prompt action in this matter.

BRIEFLY TOLD.

NOTES.—Pittsburgh, Pa., is priding itself on the recent receipt by a local firm of a check, from Mr. W. W. Harrison, of London, England, in payment for a lot of gas fixtures that were purchased in Pittsburgh by that gentleman for his residence in London.——The new gas plant at Bellingham Bay, Wash., will be completed by December 1st.——The authorities of Jersey City ask for proposals for performing the public lighting of that place, for 1 year from December 1, 1890. The competition is to close on the 31st inst.——The case of Daniel Schmeer as administrator against the Gas Light Company of Syracuse, N. Y., and others, is on trial in the Circuit Court, before Justice Williams. Mr. Schmeer sues to recover $5,000 damages for the death of his son, who was killed about 2 years ago by an explosion of gas in the Young Block, in North Salina street.——The Salt Lake Improvement Company asks for a franchise (to last for 50 years) giving it the right to distribute natural or manufactured gas for heating and power purposes, the rates to be not in excess of 50 cents per month for each cooking stove; $1 per month for each cooking range; $1.50 per month for each heater in private residences, and the same for each horse power of stationary engines.

Fireproofing Exterior Surfaces.

It is found that a most effective composition for fireproofing exterior surfaces may be formed by slacking a sufficient quantity of freshly-burned quicklime of the best grade, and when the slacking has become complete, adding such an amount of skim milk, or water in its absence, as will make a liquid of the consistency of cream. To every 10 gallons of this liquid are added, separately and in powder, and with constant stirring, the following ingredients in the order named: Two pounds of alum, 24 ounces subcarbonate of potassium, or commercial potash, and one pound of common salt. If white paint is desired no further addition is made to the liquid, though the whiteness is found to be improved by a few ounces of plaster of Paris. Lampblack has the effect of giving a number of shades from slate color to black. But whatever tint is used it is incorporated at this stage, and the whole, after being strained through a sieve, is run through a paint mill. When ready to apply the paint is heated nearly to the boiling point of water, and is put on in its hot condition. It is also found that the addition of a quantity of fine white sand to this composition renders it a valuable covering for roofs and crumbling brick walls.

Inaugural Address, North of England Gas Managers' Association.

By Mr. William Hardie, Jr.

Gentlemen,—I beg to tender you my best thanks for the honor you have conferred upon me in electing me to the position of President of your Association. Following in the wake of gentlemen of great oratorical powers, large engineering experience, and inventive genius, I feel how impossible it is for me to maintain the same high standard that has heretofore obtained in this office. I have, therefore, to ask your indulgence while I address you briefly on a few of the subjects that are at present exercising the minds of gas managers.

The subject of premier importance is undoubtedly the "labor question." Not that this is a new question, because, since there has been an employer and an employee, their relations have frequently been strained; not that trades' unions are a novelty, because they have been legalized in England for something like a quarter of a century, and were then but developments of secret societies existing for similar purposes. But during the past twelve months, there has been a perfect epidemic among workmen; and this upheaval has been simultaneous throughout the whole civilized world. This wave of labor discontent is apparently one of the results of our growing civilization. It is brought about by the workers having formed a higher ideal of living—the luxuries of a previous generation being considered necessaries, and the standard of living having been generally raised. Our Socialists friends claim that they have produced this higher ideal; but this, at least in England, is, I think, very doubtful—the Socialists only forming an infinitesimal number among the great mass of workers. It has been said that "one-half of the people do not know how the other half live." No doubt cheap literature and better education among the workers are dispelling this ignorance; and we find, in consequence, each class endeavoring to improve its position, and trying to attain to the higher standard of life practised in the class immediately above it in the social scale.

About June last year was formed the Gas Worker's Union. This and similar unions of unskilled workers have been called the "New Trades Unionism." The difference between the new and old trades unionism is that the former confines itself to trade benefits, or benefits paid in cases of disputes; whereas the latter are also largely friendly societies. Whether or not these new unions will succeed in keeping together their members, with no other than trade benefits to offer, seems rather doubtful; previous societies of this kind having been of temporary duration. The right of workmen to combine for their mutual protection, and for the purpose of improving their position, has long been recognized. Consequently trades unionism has received a large amount of public support; and trades unionists can now be counted by the million. The new trades unionism is, however, very anxious to add another plank to the trade union platform, and that a very dangerous and unjust one. It affirms that the time has arrived when a workman cannot be allowed "not to combine," but that he must be forced into a union, no matter how much barbarous and bloody coercion may be necessary to attain that end. Surely, the very acme of tyranny and cowardice has arrived, when we find organizations, composed of many thousands of workmen, setting themselves to deprive from work a few whom they cannot persuade to join them. The split at the Trades Union Congress shows that the methods of the new trades unionists do not generally commend themselves to trade unionists properly so called.

Another innovation that the new trade unionists are striving hard to introduce is the forcing of strikes in kindred industries to those in which there is a dispute. There can be no justice in pressing a strike where there is no grievance between employer and employee; and it is pleasing to know that such tactics have usually been abortive. The Salford gas stokers, for instance, did not gain anything by joining in a dispute with which they had nothing to do. The threat to stop the coal supply to all London during the strike at the South Metropolitan Gas Company's works is the worse case of this kind; but it is some satisfaction to know that the "bark" was worse than the "bite" of the proposers of such glaring injustice.

A great statesman once reminded some of the enemies of this country that "the resources of civilization were not yet exhausted;" and if the new trades unionist thinks to obtain his ends by injustice and brute force, he must not be surprised if the British public sweeps both him and his new trades unionism away, and gives us all that "individual liberty," which "the greatest good for the greatest number" demands. Much mischief is often caused by professional agitators, who, to serve their own ends, go about persuading workmen that the interests of employers are antagonistic to theirs. The fact is that, instead of such being the case, their interests are bound up together; and good times for employers are invariably also good times for the men employed. The life of the professional agitator cannot be indefinitely prolonged. Already he is terribly shaken by arbitration and boards of conciliation, co-operation and profit-sharing, and similar schemes for harmonizing the relations of capital and labor will make his profession unremunerative, and he will then pass into that oblivion from which he came.

Productive co-operative societies owned by workmen have not yet been carried out to any very large extent; but progress is being made. Much good may, I think, be expected from such societies of workmen, because in their case the capitalist and worker will be one; and such a combination of workmen will be able to compete with the large employer, who will be obliged to make his wages and profits square with those of the workers themselves. Profit-sharing is no novelty, even in connection with gas works. Mr. Travers, of Cork, read a paper before the Gas Institute a few years ago bearing on this subject; and since then some progress has been made. Mr. George Livesey has, on a large scale, introduced it into the works of the South Metropolitan Gas Company, and has there made it a thorough success. I have had the pleasure of visiting the works of the South Metropolitan Company, and have also carefully read the report of the very enthusiastic meeting between the Directors and workmen held on July 26; and I feel convinced that, for overcoming the terrorism of the new trades unionism, and creating confidence between employer and employee, profit-sharing holds the field.

On the 1st of January this year, we commenced to work the retort houses with three shifts of men in the 24 hours, instead of two shifts. As the one shift does not remain at work till the next shift arrives, the average length of shift is 7¾ hours; and as 2¾ hours of this is devoted to rest and meals, the actual time that the men work is about 5 hours out of the 24. The wages are 5s. 5d. per shift; time-and-a-half for Sunday labor; and three days' holiday, with full pay, to summer workmen. The workmen appear to appreciate the change to the three shifts; and I find the work carried on as efficiently as with the two shifts. In consequence of these changes, the charge for retort-house labor has increased from 2.8d. to 3.8d. per 1,000 cubic feet of gas produced, or 35 per cent.

Another item of interest, and one which, like the wages question, also affects the balance-sheet on the wrong side, is the price of coals. During 1889, coals rose, on an average, something like 50 per cent. In last year's accounts, this was, of course, barely felt; most gas companies being contracted for up to the end of the year. But those who sought to renew contracts about the beginning of the year were surprised at the higher prices asked. Many outsiders—aware that miners wages were higher, and that pit timber and other small items incidental to the getting of coal were also dearer—were yet unable to understand why the prices kept so high. Some there were who thought it was due to a "ring" among the coal owners. As a matter of fact, no such "ring" exists. A syndicate among the coal owners of this country has been proposed; but the great risk and probability of failure has up to the present prevented it reaching beyond this stage. I doubt very much indeed, if such a syndicate were formed, whether it conld protect itself very long from internal weakness and the great pressure that would be brought to bear upon it from without. The high price of coal is probably to be accounted for in a simpler way than the above. The demand has been good, in consequence of the generally improved state of trade; miner's wages have been high; and, consequently, the output has been more restricted. My Directors made a very good contract for this year, at an increase of 28 per cent.; but even this augments the expenditure by nearly 2½d. per 1,000 cubic feet of gas. The increased expenditure on coals and labor is further supplemented by higher prices charged for building materials of every kind. All these items are beyond the control of the gas manager. He has simply to accept the market values as they stand, and see that he pays no more. This being so, I wish to draw your attention to a few of the ways in which gas managers are trying to counteract the effect of this largely increased expenditure.

My friend, Mr. Bower, will introduce, as a subject for discussion at this meeting, the price of gas in relation to the price of coal; and, therefore, I shall not touch upon that subject, but confine my remarks to two points—viz., our residual products; and recent improvements in gas manufacture. Last year we received for residuals about 78 per cent. of the cost of the coal; and this fact is, I think, sufficient to show the very important bearing that the manufacture and disposal of residual products has upon the selling price of gas. The value of coke is ruled to some extent by the price of coal; and thus this year it will show an increase of about 30 to 50 per cent. The quantity produced from each class of coal is almost fixed; but the amount for disposal is very elastic, depending upon the quantity used on the works, which varies in different works from about 2½ to 6½ cwt. per ton of coal carbonized. To the fact that "dust furnaces" for the use of breeze, etc., in boiler furnaces are

becoming more common, and that considerable economy can yet be made, as opportunity offers, by many of us in using the fuel required for carbonizing more scientifically, we may I think look for increased revenue in the future. Many gas managers now break a large quantity of their coke into a size more suitable for household purposes; and from such broken coke, they receive from 1s. to 2s. per ton extra profit.

It has long been considered the most economical practice to work up the ammoniacal liquor at the gas works where it is produced; and recently the attention of gas managers has been directed to the advisability of adopting the same practice in regard to their tar. At the meeting of the Manchester District Institution of Gas Engineers on Aug. 30 last much interest was evinced in the manufacture of tar products as carried out at the Lancaster Corporation Gas Works. It was stated that the products realized £2 9s. per ton, against £1 7s. per ton for tar, or a profit of £1 2s. Interest on capital, labor in manufacture, and wear and tear, would, I suppose, require to be deducted from this; but, even then, there must be a large extra profit. Unlike coke and tar, the market for sulphate of ammonia has not advanced, but, on the contrary, has fallen about 10s. per ton since last year. In the sulphate of ammonia market, prognostication is generally unsatisfactory, as there the "unexpected generally happens;" but, as prices have not fluctuated very much during the past 3 or 4 years, we may hope that present prices will be maintained. If we are to receive a larger revenue from sulphate of ammonia, we must look for it in an increased production from a ton of coal, as the price is hardly likely to go up a great deal, because any large rise would be sure to considerably stimulate increased production from coke ovens, blast-furnace gases, and other sources that at present put very little on the market. Newcastle coal produces, on an average, about 20 lbs. of sulphate of ammonia per ton when carbonized in the ordinary way; but if all the nitrogen in the coal could be procured in this form, the quantity would be increased many times. Several processes have been proposed for producing a larger quantity per ton of coal; but up to the present, they have only attained a small amount of success. In this direction, much yet remains to be done. We should also endeavor to increase our local consumption among farmers and market gardeners, as this is a trade that would be mutally beneficial.

Let me now draw your attention to a few of the improved methods of cheapening the production of coal gas. The Dinsmore process for converting a portion of the tar into gas has, since Mr. Isaac Carr communicated his paper on the subject to the Manchester District Institution of Gas Engineers in November last, received considerable attention. In ordinary carbonization, care is taken to have as much of the light giving hydrocarbons as possible kept in the gas; but the control that can be exercised for this purpose is comparatively limited. The producing of gas from tar had, prior to the Dinsmore process, been considerably experimented with, but with invariable failure. When the price of tar was so low three or four years ago, experiments were directed to the quantity and quality of gas to be derived from tar. Nothing appears to have come of these experiments, and the idea was becoming prevalent that practically it was quite impossible to distil tar for the production of illuminating gas without the exit pipes becoming continually choked up. The Dinsmore process consists essentially in passing the gases, immediately they are formed, through a "duct" heated to a given temperature, and then through an ascension pipe fitted with a water jacket. Superheating the gases in the "duct" renders a portion of them permanent, which would, in the ordinary working, be condensed and carried into the tar well. The water jacket, in conjunction with the graduated heat in the "duct," prevents the choking up of the exit pipe. The process shows that a portion of the tar can be utilized for the production of gas of a high illuminating power. The process being in the experienced hands of Mr. Carr, a thorough success (both practically and commercially) is evident from the fact that it has been working about two years, that new ovens are being put up on this system, and that the members of the Local Board appear thoroughly satisfied with the saving effected. The Dinsmore process is now being tried at several other places; and many wait to see if the success of it is indigenous to Widnes, or if it flourishes equally well elsewhere. The process is said to give an additional 30 per cent. in illuminating power, and something like 10 per cent. increase in quantity; and certainly, if results anything approaching this can be regularly maintained, we may expect it to take a very important place among recent improvements for cheapening the production of coal gas.

During the past 12 months we have had introduced into England M. André Coze's inclined retort. This, being a very great departure from the ordinary horizontal retort, which has served so long, has received a considerable amount of attention. Mr. Morris, of the Brentford Gas Company, was the first to adopt it at Southall, and many of us have had the opportunity of seeing it there. Already English engineers are trying inclined retorts slightly altered in details from the original plan; and we may anticipate shortly to have further particulars as to any advantages they may possess. The advantages claimed for it are: That the labor is easier; that there is less dependence on trained stokers; and that one-half the number of men can do the work.

Machinery for charging and drawing retorts, for conveying coke from retort ovens, and for many other purposes, has lately become much more common; and as machinery does not go "on strike," and men lately seem to do little else, there is no doubt that, wherever work can be done as cheaply by machinery as by men, the masters will prefer the former. Considerable saving invariably follows the introduction of machinery into gas works, but each individual case must be considered on its merits.

I have mentioned only a few of the things that tend towards the cheapening of coal gas; but doubtless other processes, both mechanical and chemical, will suggest themselves to most of you. Sufficient has, however, been said to show that we have not yet attained to anything like finality as regards cheapening the production of coal gas, but that there still remain many ways in which this cheapening process will be carried on. If it is necessary, owing to the high price of coals, etc., to raise the price of gas, and thus make a stop in the gradual reduction which has been so long the order of things, we may at least expect that this break is not by any means permanent, and that the cheapening of gas will soon go on again.

During the last few months, water gas has made its appearance in England, as a competitor among the illuminating agents used for street lighting. This gas is a mechanical mixture, of about 42 per cent. of carbonic oxide, 50 per cent. of hydrogen, and 8 per cent. of nitrogen and carbonic acid. A few days ago, being at Harrogate, I took the opportunity which is kindly afforded by the British Water Gas Syndicate, of making a cursory examination of the plant erected there for the production of water gas. The process of manufacture in the producer is intermittent; about 20 minutes being utilized in raising the temperature of the coke by the introduction of air, during which time "generator gas" is produced. This gas contains more than 60 per cent. of nitrogen, and is used for heating the boiler. The air is then shut off, and steam introduced for about 6 minutes, during which time something like 2,500 cubic feet of water gas is produced. The steam, in passing through the red-hot coke, is decomposed, the oxygen combining with the carbon and the hydrogen being liberated. Pure water gas would, therefore, by volume consist of 50 per cent. of hydrogen and 50 per cent. of carbonic oxide.

Carbonic oxide is very poisonous, and much has therefore been said about the propriety of using a gas containing such a large percentage of it as water gas does. In water gas there is about 42 per cent., in carbureted water gas about 30 per cent., and in coal gas about 8 per cent. of this gas. Recent American practice shows that, *cæteris paribus*, the general public care very little what quantity of carbonic oxide illuminating gas contains. The novelty of the Harrogate experiment consists in the light being produced by a magnesian comb raised to a state of incandescence. It is a well known fact that in the United States about one half of the gas used for illuminating purposes is water gas; and this has been used as an argument to show that water gas must make rapid progress in England. There is, however, no parallel between the two cases. In America water gas gets its lighting power from very cheap petroleum spirit, and in England by a magnesian comb, which only serves about 100 hours, and during which time its illuminating power is gradually decreasing. It has been said that, during this 100 hours, the illuminating power is reduced from about 20 to 10 candles; but more exact information is desirable. Again, in England coal gas is only about one-third the price of coal gas in the United States, and, consequently, water gas has a much more powerful rival to deal with. The cost of water gas is stated by the promoters to be less than half the price of coal gas; and if this is so, it should be able to replace electricity, coal gas, and oil. Time will show; but in our day I do not expect to see any such transformation. The experiments on carbureted water gas at present being carried out by Mr. Trewby, of The Gaslight and Coke Company, are of much more interest to us as gas managers. Carbureted water gas can be mixed with any proportion of coal gas, and the illuminating power increased in this way. Many advantages occur from using a carbureted water gas plant as an auxiliary to coal gas, and we may look for valuable information on this subject from the Beckton experiment.

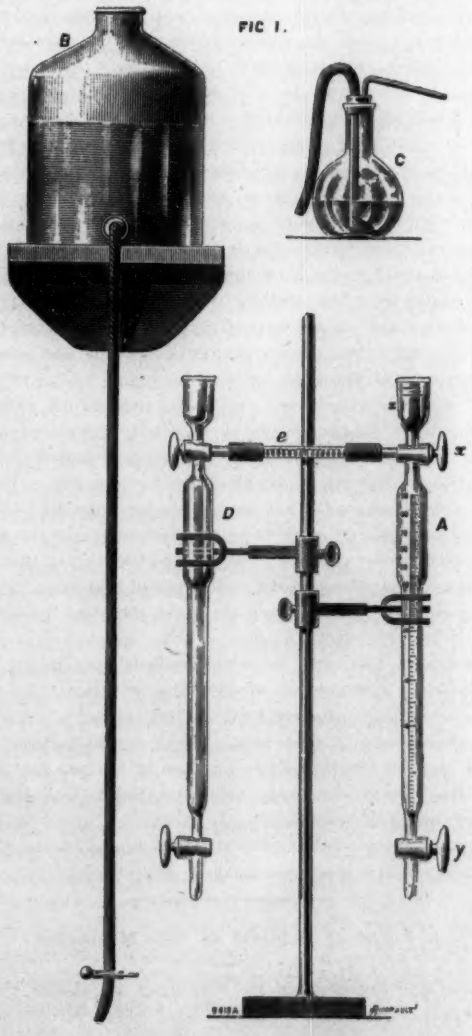
In conclusion, let me express the hope that some measure of profit and pleasure may result from our meeting to-day, and that the same harmonious spirit which has always pervaded our gatherings will be maintained.

Flue Gases from Steam Boiler and other Furnaces.*

To develop the maximum amount of heat with the minimum expenditure of fuel is an object generally desired in all furnaces, and those that give such a result are rightly considered the most efficient. But the efficiency of a furnace depends on so many points that it is of very great importance to be able to determine, without too much trouble, whether the necessary conditions are being fulfilled. This may in some cases be ascertained by comparing the quantity of work done with a given amount of fuel; as in the case of a steam boiler by the amount of water evaporated with a given weight of fuel. But since the result, when obtained, gives us the efficiency of the whole apparatus, it is often necessary to know more particularly what the fires themselves are doing. An analysis of the furnace gases is by far the best tell-tale of the state of the fires, for from it we can learn whether or not the conditions of stoking should be changed and more or less air admitted to the fires; whilst if, in addition to the analysis, we know approximately the percentage of combustible matter in the fuel, and the temperature at which the gases are rejected, we can determine with some accuracy the amount of heat which is passing to waste into the chimney.

The reason why the examination of furnace gases is so seldom attempted is that the operation is generally thought to be one of considerable difficulty, and only to be carried out by an experienced chemist. Such is far from being the case, for there are several methods which neither require a great amount of manipulative skill, nor make a large demand on the time of the operator in carrying out the analysis and reducing the results to the required form.

FIG 1.



It is proposed in this article to describe some simple methods of analysis, and to deal with just so much of the chemistry of combustion as will enable an engineer, who is not also a chemist, to learn all he may wish to know from his own analysis.

For rapidity of execution, volumetric methods of analysis are far preferable to gravimetric processes. There are several volumetric processes in general use; of these the best known are: (1) Bunte's; (2) Orsat's; (3) Stead's, and a fourth described by Mr. C. J. Wilson, F.I.C., of University College, London. Bunte's apparatus consists essentially of a glass measuring vessel which may be entirely inclosed in a water jacket. It has two stop-cocks, and a cup so arranged that by turning the upper stop-cock x (Fig. 1), which is a three-way, the interior of the burette may be put into communication with either the water in the cup or the air outside, or, when necessary, with the supply of the gas to be examined.

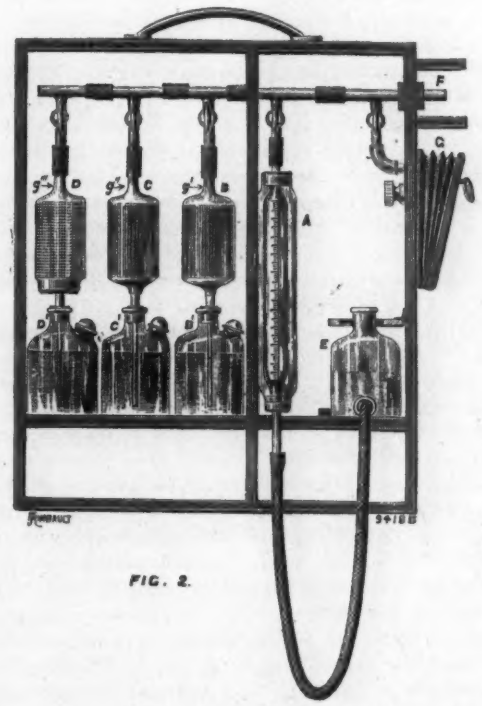


FIG. 2.

The burette should be supported in a vertical position by a clip from which it can be easily removed and replaced as required, and a large jar of water B should be conveniently placed at such a height as to allow of the burette being filled from it. The general arrangement of the apparatus is shown in Fig. 1. A is the burette, x the three-way cock at the top, y the two-way cock at the bottom, and z is the cup. B is the water jar, which is to be used in preference to taking the water direct from the ordinary service, because the latter is generally several degrees colder than the room in which the operation is performed, and so would cause the gases in the burette to contract and render corrections for change of volume necessary; by having the water supply of the same temperature as the room this complication is avoided. It is provided with a flexible tube, by which it can be connected with the lower cock y. The burette is of about 110 cubic centimeters capacity, and is graduated to show 0.2 cubic centimeter, the 100 being at the upper cock x, and the 0 a little distance above the lower cock y. The various furnace gases which can be estimated by this process, and which are practically all that it is necessary to know in the case of furnace gases, are carbonic acid (CO_2), oxygen (O), and carbonic oxide (CO), and the deficiency of the total of these from the original quantity of gas examined. By a supplemental process hydrogen can also be determined. The reagents to be used to absorb these various gases are for carbonic acid, (CO_2), a solution of caustic soda or caustic potash; for free oxygen (O), a solution of an alkaline pyrogallate; for carbonic oxide (CO), a solution of cuprous chloride in hydrochloric acid.

In making an analysis the burette is filled through the cock y from the reservoir, by means of the flexible tube, and the quantity of water is so adjusted that it stands at the level of a mark on the cup to which it is always brought before a reading is taken, and a constant pressure in the burette is thus obtained. The upper stop-cock x is now connected with the supply of gas either by a pipe leading direct to the flues, or to a sample bottle in which a portion of the gas to be analyzed has been secured, and the burette is charged with the gas. The amount drawn into the burette is now measured off, and, if required, adjusted to exactly 100 cubic centimeters, care being taken that it is first brought to the temperature of the room, and that it is under the standard pressure due to the level of the water in the funnel. The analysis proper is then commenced by closing the upper cock and making a partial vacuum in the burette by drawing out some of the liquid by means of the suction bottle C; the caustic potash is then applied in the small dish below y, and is rapidly forced into the burette when the cock is opened. The burette is

*Engineering.

now taken from its stand, both cocks being carefully closed, and shaken vigorously, when, after readjusting for temperature and pressure, the level at which the liquid stands is read off, and this at once shows what volume of carbonic acid gas has been absorbed. As the partial vacuum, caused by the absorption of the CO_2, is made good from the cup z, care must be taken to keep the latter well filled when the upper cock is opened to adjust the pressure in the burette. It is well to make second shaking and adjustment so as to insure all the carbonic acid being absorbed. The solution of an alkaline pyrogallate for the next process, the absorption of the free oxygen, is made by adding some pyrogallic acid to some of the caustic potash solution. It is applied in exactly the same manner as the caustic potash was for the carbonic acid, but as it absorbs the gas less readily than the caustic potash does the carbonic acid, several shakings and adjustments are often necessary before the correct result is obtained, which is shown when the last shaking causes no further absorption. It must be remembered that the process is cumulative. The quantity of oxygen being now abstracted from the sample from which the carbonic acid was previously taken, the amount of oxygen absorbed is shown by the difference between the two readings after the carbonic acid and oxygen absorptions.

Previous to the determination of carbonic oxide all trace of the pyrogallate must be removed from the burette before the introduction of the cuprous chloride; this is easily effected by allowing a stream of water to run through the burette from the cup, and can be accomplished without danger of loss, provided only the level of the water in the cup is maintained; it is well, however, to take a new reading when the pressure has been adjusted after the washing process. The cuprous chloride which is used to absorb the carbonic oxide is precipitated from its solution in hydrochloric acid if it comes into contact with water; it is necessary, therefore, not only to make a vacuum in the burette before it is applied, but also to remove by the suction bottle as much of the water as possible. As only one adjustment of the pressure is allowable in this case, on account of the cuprous chloride being precipitated by the water let in, it is necessary that the shaking should be a thoroughly good one, and also before a reading can be made the hydrochloric acid should be all washed out, and it is an advantage to run also a little caustic potash through the burette, which readily takes up any fumes of hydrochloric acid, which, if not absorbed, would vitiate the result.

Carbonic oxide may also be estimated by combustion; the process is a little complicated, but it is very interesting, and, moreover, allows of any hydrogen present being estimated, as well as the carbonic oxide. For this operation a second burette D, similar to the first, must be used, and should be supported if possible on the same stand with the first one. The carbonic acid and oxygen being determined, the gas is allowed to mix with atmospheric air by opening the cock x to the air and running a little water out at y; the normal pressure is then established and a reading taken. Connection is now made between the first and second burettes by means of a piece of hard combustion tubing e, containing a small coil of palladium wire. The second burette is now filled with water, the palladium wire in the combustion tube brought to a red heat by means of a Bunsen burner, and then the gas from the first burette is made to pass slowly over the heated wire into the second burette, and then returned into the first. If hydrogen and nitrogen only are present, the diminution in bulk, when under the standard conditions, will show that a certain volume of hydrogen and oxygen have combined and formed water, which has been condensed, and the diminution in bulk multiplied by $\frac{2}{3}$ gives the volume of hydrogen. Suppose there were present 2 cubic centimeters of hydrogen and 16 cubic centimeters of nitrogen, whilst 26 cubic centimeters of air have been admitted, making a total of 44 cubic centimeters before combustion; after the combustion the volume is found to be 41 cubic centimeters, showing a loss of 3 cubic centimeters, which, since water has been formed, must have consisted of two-thirds hydrogen and one-third oxygen, or, in this case, 2 cubic centimeters of hydrogen are shown to have been present. The presence of carbonic oxide before combustion is shown by the presence of carbonic acid; after combustion the quantity of carbonic acid present is determined as in the original test by its absorption by caustic potash. Suppose the figures to be as above, but that after treatment with caustic potash there is a further reduction in volume of 1 cubic centimeter of carbonic oxide in the original sample, because for every volume of carbonic oxide burnt an equal volume of carbonic acid is produced, and since this 1 cubic centimeter of CO must have consumed half its volume of oxygen, we determine the hydrogen thus:

$$(3-\tfrac{1}{2}) \times \tfrac{2}{3} = 1\tfrac{2}{3} = 1.66 \text{ cubic centimeters of hydrogen.}$$

The nitrogen is then calculated by difference.

The whole process can be easily completed in 15 or 20 minutes, and from such an analysis we should see at once whether combustion was complete or whether too much air was being drawn through the flues, the two extremes between which economic working must lie.

Very often it is enough to determine only the amount of carbonic acid, which, of course, very much simplifies the operation. This test may also be used to find out if there is any considerable leak of air into the flues. Two samples are taken simultaneously from the flues at different points of their course, and the percentage of carbonic acid determined for each sample; if now the sample taken at a point further from the fire contains an appreciably lower percentage of carbonic acid than the other, it can at once be seen that the gases have been diluted with air, and by drawing samples at several points the leak can often be located and stopped with advantage to the furnace.

Orsat's apparatus* consists of the measuring tube, which is surrounded by a water jacket to protect it from changes of temperature. It is graduated for a portion of its length in one-fifth of a cubic centimeter, and contains exactly 100 cubic centimeters when filled to the cock in the capillary tube at the top. The measuring tube is connected at the top with a T-piece, one arm of which carries a three-way cock and the other three branches of capillary tube, each with a glass tap; these again are connected by india-rubber joints with three absorption vessels of the shape shown in the figure. Two of these vessels, B and C, Fig. 2, are filled with bundles of glass tube, and the third, D, with a coil of copper gauze which, after being wetted by the absorbing re-agent, offers a large area of wetted surface to the incoming gas. The first of the three lower chambers connected to these vessels is filled with a solution of caustic potash and serves to absorb the carbonic acid gas. The second contains an alkaline solution of pyrogallol, and the third a strong solution of cuprous chloride in hydrochloric acid to absorb respectively carbonic acid, oxygen, and carbonic oxide, as in Bunte's process described above. On the capillary tube at the top of each of these vessels there is a mark to which the level of the liquid is brought after each stage of the process. In order to manipulate the gas when in the apparatus a level bottle E is connected to the bottom of the measuring glass, which, as it is raised, causes the gas to flow into the measuring glass or absorption vessels as required. In taking a sample, the whole apparatus, which is contained in a convenient wooden case with sliding doors, is brought to the side of the boiler, or elsewhere, as required, and the outer end of the capillary tube F connected to the sampling pipe by a length of flexible tubing. The pipes are emptied of air by a few strokes of the bellows G, provided for the purpose, and then the cock is turned so as to put the sampling pipe into communication with the measuring glass, which has previously been filled with water acidified with hydrochloric acid. By lowering the level bottle the water is withdrawn from the measuring glass, and is replaced by a sample of gas, which is carefully measured off, and then sent into the first absorbing chamber, where it is caused to flow over the moistened glass by raising or lowering the level bottle. The gas is then returned to the measuring glass, and its diminution in volume, as read off, shows the volume of carbonic acid absorbed. In the same manner the oxygen and carbonic oxide (if any) are absorbed in the other vessels, care being taken that the liquid in each vessel stands at the mark g', g'', or g''' in the capillary tube when the gas is returned to the measuring tube.

This apparatus is, perhaps, more convenient than Bunte's. It can be carried to its work and used in almost any situation. It is quite self-contained, and enough re-agents can be put into the absorption vessels B' C' D' to serve without renewal for 20 or more analyses. On the other hand, the method of absorption, by passing the gas over wetted tubes, is probably less effective than the vigorous shakings of Bunte's process, whilst the necessity of accurately adjusting the level in the capillary tubes of the absorbing vessels introduces the possibility of further errors.

[To be continued.]

A Point of Interest to Gas Managers.†

The position and prospects of gas managers is a theme that naturally possesses perpetual interest to actual and prospective members of the class; so that a few words on the subject are always appropriate and timely. It is not our present intention to discuss with any pretence to fulness the conditions of the gas managers' calling as it is pursued at home or abroad, in the Metropolis, or in the provinces. Hardly a *Journal* appears without some portion of its contents illustrating, directly or indirectly, some circumstance of the gas manager's career. The troubles of his employers, as revealed in our news columns, are generally very

*See "Handbook of Technical Gas Analysis," by Winkler and Lunge, published by Van Voorst, London, page 47.

†London *Journal*

largely his troubles; and similarly, though it is to be feared in a smaller degree, their prosperity is reflected in his own. If gas managers were always treated as they think they deserve, they would form a remarkable exception to every other order of the industrial and commercial community. We have always been anxious to use the influence of the *Journal* for the best advantage of the gas managers who constitute such a numerous class among our readers. The advancement of the gas industry, and the prosperity of all who are identified with it, are twin objects which we never leave out of sight, as reference to our published columns will testify. It has been recognized and maintained in these pages that the future of the gas industry is bound up with that of gas engineering, as the future of gas engineering is connected inseparably with the prospects of its practisers. Consequently, we have always contended that the representatives of capital who sit as boards of directors, or municipal gas committees, should, for their own sakes, if for no higher motive, preserve a career for the gas engineer by connecting reasonable salaries with all such appointments. The tendency of ignorant and miserly directors and committee-men to intrust important gas undertakings to what such people are fond of calling "practical men," is a standing evil which must be combatted in season and out of season. Over and over again these scandals are perpetrated; and the folly of such appointments is unperceived simply because those responsible for them shut their eyes to every consideration beyond that of "penny wisdom." There are two kinds of motives that induce directors and committee-men to act in this way. The first is meanness, pure and simple. They can get their "practical man," as they call him, cheap at first hand; and the reflection that may possibly be dear in the end never occurs to them. The other motive is ambition, or meddlesomeness, or something of the sort, on the part of the chairman, or some other high and mighty personage, who prefers as gas manager a slave rather than a competent adviser. More than one chairman of gas directors, and committee of a town council, entertains the conviction that he is a heaven-sent administrator. He hints as much to the awe-struck reporter for the local paper which favors his party; and consequently many a little personal note is put in circulation, exhibiting Mr. Chairman's wonderful tact with the workmen, his business capacity, or some other conspicuous virtue. A big-wig of this stamp does not want a calm and skillful engineer, of equal or perhaps superior education and social standing, to take away any portion of his glory. It is not the salary of a capable engineer that such a magnate objects to; he would gladly pay a good sum for a devoted admirer, whom he could depend on to systematically efface himself. It is because Mr. Chairman will not run the risk of meeting his master that he insists upon managing the undertaking himself, through a foreman, instead of permitting an engineer to take charge, and show what good management means.

It is a grievance of young engineers that the smaller order of gas undertakings, which would afford them a good start in independent experience, are commonly left to foremen stokers or mechanics who work under the supervision of secretaries or directors; all extensions being executed by consulting engineers. The consulting engineer is thus occasionally regarded as the enemy of the gas manager, taking the latter term in its best signification. This is not so, except in a wholly insignificant degree. There are many gas works, more particularly in the manufacturing districts of the North of England, in which an educated young engineer would be buried alive. Built to supply a group of mills and the population of a mill village, these works may be of considerable coal carbonizing capacity, and yet afford no scope for any man of higher aims and fuller equipment than a working man born in the locality. In such employment, a locally-bred foreman may be content; whereas a well-brought-up young engineer would eat his heart out. Here then the working foreman and the consulting engineer find a fitting field. It is otherwise, of course, when the gas supply of a good town is left to the tender mercies of a foreman in residence, and a consulting engineer paid by commission on the capital spent by his advice. The awakening from such a course of administration is generally delayed until the death or retirement of the consultant, who is necessarily careful to keep on the "blind side" of his employers; and when it comes the undertaking is usually found weighted with capital obligations that a generation of strict economists can hardly hope to clear off. Even worse is the lot of the gas company or corporation who have not even a consulting engineer to keep them straight, but go on with an unequal team consisting of a headstrong director or alderman and a foreman in charge of the works. Everything is done from hand to mouth in such undertakings. The larger economies are allowed to slip by unheeded, because unperceived; and the amateur administrators comfort themselves with the thought that, if anything should go very wrong, they can always send to London or somewhere else for an eminent man to put them right. As we have pointed out on previous occasion, these people never think what would be their fate if everybody else were to do as they do, and neglect to provide for the training of the engineers upon whom dependence must be placed after all in the hour of emergency.

If the gas engineer is yet in too many localities looked upon as a superfluous luxury, as foolish people regard physicians—only to be called in after a long course of domestic quackery has brought the patient to death's door—in some other places he is more fairly treated now than was formerly the rule. It is impossible to shut one's eyes to the fact that the handsome, roomy engineering structures which are to be found in most of our prosperous gas works of to-day, where they utterly dwarf the poor and dirty memorials of a bygone age, symbolize a corresponding advance in the circumstances of the engineer. In a well administered gas works supplying a self-respecting town, the leading stokers are as well off now as the man who was called the manager was in a by no means remote past. This is, of course, where the owners of the undertaking understand what is due to themselves and their property, and realize that stability, order, progress, and appropriateness can only be exhibited where the master possesses the character and accomplishments which in action have these expressions. Fortunately these examples are not few and far between in our land, which is still the school (as it was the cradle) of gas engineering.

Among other evidences of the changed conditions of the gas manager's calling at its best, may be cited the comparatively modern abandonment of the mediæval tradition that the manager ought to live upon the works. It is happily seen that the towns where the manager is condemned to live in or immediately adjoining his works are becoming fewer every year; and we desire to take this opportunity for advocating the rapid extension of the movement. Whatever may have been the case when the manager, except in very large works, was his own foreman, and when the arrangements of the plant, being of a more rudimentary description than is usual now, could not be depended upon for many hours together, there is at the present time no real necessity for insisting upon the manager working 24 hours per day, and being helped by his wife and family—which is what living in the works amounts to. When the manager's house is in the works, he is never off duty. Discipline among the men and self-reliance on the part of the foreman and leading hands can never be perfect while there is the possibility of instant appeal by day or night to the manager. A manager who is always in or about the works has his men in leading strings, which worry him and them, yet which he dare not relax for a moment. Every little hitch and worry which the foreman could and would bear if the manager were out of the way, falls upon him; while perchance he is sufficiently strained by more important cares. It is the mosquito bites that worry a man to death; and from these the manager who lives in the works is never free. The difference between the circumstances of such a man, and those of the manager who can lock up his office when office hours are over, and turn his back upon it all until the morning, requires to be experienced to be properly realized. In short, the custom that still obtains in certain towns, of requiring the manager to live in or adjacent to the gas works, is a survival from another age, when all the conditions of the calling were different.

It would be impossible, of course, to draw a hard-and-fast line in a matter of this kind; and all we contend for is the general recognition of the principle that gas managers should be delivered from their traditional watch of 24 hours a day. We could name gas works in the kingdom where the manager's residence, although technically upon the works, is practically separated from them, and is really pleasantly situated. In other places the poor manager and his family have to live in a dingy, damp, unhealthy, and lonely hole, where his only visitor is the doctor, and his neighbors are specimens of the lowest orders of the community. Where this latter state of things is merely the result of superstition, it is high time a change should be made. Nobody would pretend that the manager of a gas works should be inaccessible after office hours; but we mean to say that the advantages of having him constantly on the spot are grotesquely exaggerated. If he cannot so design and regulate his works that they will go for a night without him, he is unworthy of his position; and in times of emergency he would be equally unworthy of his trust if he could not sacrifice his comfort so far as to spend as as much time at the works as might be required. Under ordinary conditions, however, an educated and respectable man in the position of a gas manager ought to be permitted to live and bring up his family amid suitable and healthy surroundings; and if these do not exist in regard to his traditional official quarters, he should be encouraged to select others. If there are gas directors and committeemen anywhere who have not taken these considerations to heart, we trust these words of ours will arouse them to a sense of their duty. In default of this re-

minder proving effectual, it is to be hoped that every gas manager cursed with a lonesome, unhealthy dwelling house on his works will lose no time in discovering that the site is imperatively needed for some urgent extension of the plant. A little of the wisdom of the serpent is not amiss when selfishness or stupidity in high places has to be circumvented.

Domestic Electric Lighting.

A writer in *Specialties* indulges in the following odd statements respecting domestic electric lighting, the figures in which apply to English examples of the matter under consideration :

It is comparatively easy in these days of advanced science to provide for the efficient lighting of large buildings by electricity, for in the first place the cost of such large installations is not a prime consideration, so that there be no failure in the light ; and secondly, the complete sets of apparatus forming the specialties of the best firms enable the contractors to fulfill their engagements with success. But the more humble requirement of the householder who wishes to indulge in the luxury of the electric light on a small scale, and is not inclined to wait for those happy days when the electric mains will be "laid on" like water or gas, is a matter of greater difficulty, partly because he is necessarily restricted as regards expenditure, and also because it is a *sine qua non* that there must be no trouble involved in maintenance, or any element introduced that is likely to be a nuisance to himself or his neighbors.

We will, for purposes of illustration, assume that the proprietor of a 12-roomed villa wishes to fit up an installation of electric light at the smallest possible cost. The hall, we will presume, is sufficiently lighted by one 20-candle power incandescent lamp, and the dining and drawing rooms both by an electrolier of four 20-candle power, and two brackets with a 10-candle power lamp upon each. It is not necessary that both of these rooms should be fully lighted at once, therefore the side brackets may be left alight, and the electrolier switched off in the room that is not in use. We will presume that four other 20-candle power lamps are in use about the house, in addition to those already mentioned, therefore the total candle power of the installation will be :

Dining or drawing room (full light)	100 c. p.
" " (partial light)	20 "
Hall	20 "
Other rooms, offices, etc	80 "
Total	220 "

Adding to this the loss of energy in the main leads and branches, generator, etc., the total energy required would be represented by 1¼-horse power, whatever source of power be employed. This may be a gas engine driving a dynamo, which is coupled directly to the main leads, or a hot air or atmospheric engine may be used as a substitute for the gas engine.

But the best and most efficient installation, although costing more at the outset, is to use a gas engine of 1 indicated horse power, and permanently fit it up in the cellar, or any part which may be partitioned off, so as to form an engine room that may be locked up and kept free from meddlers. This should be lined with match boarding, for the better exclusion of dust, and, if possible, the engine and dynamo should be fixed to an anti-vibratory foundation. The dynamo should preferably be driven by friction gear directly from the fly-wheel, and the leads coupled to the accumulator cells, standing on a raised bench round the walls of the engine house. The gas main should be looped, so as to be carried out of the engine room to any part of the house that may be desirable, and there the tap or cock may be fixed, and in connection there with a switch, coupled to one of the leads between the dynamo and the accumulator in such a manner that the action of turning on the gas also establishes connection between the generator and the secondary cells. Every journal and bearing upon the engine and dynamo should be provided with automatic lubricators, holding a sufficiency of oil. A voltmeter and ammeter are also indispensable in the engine room, and a small shelf, with a diary and pencil, are also useful adjuncts. A 20-candle power lamp, the holder of which is continued to form a handle, with a ring for hanging up when not in use, should be connected by means of a flexible double wire to the main leads, serving the purpose of a handy lamp for the engine room, with all portability of a candle or oil lamp without the dirt or danger thereof. A wire guard over the globe will protect it from damage.

We will presume that the master of the house is a tolerably early riser, to allow half an hour in the engine room before going to business. He first switches on his portable lamp, and by its light fills all the oil cups, and ascertains that the tubes of them are clear. Then he looks at the secondary cells, to see that the liquid level in each is at its normal height, and going outside to the cock upon the gas main, turns it on, at the same time, of course, establishing electrical connection between the dynamo and the accumulators in the manner before referred to. The dynamo, being of that type known as "shunt wound," immediately revolves as an electric motor under the influence of the current from the cells in the same direction as when charging, and the shaft of the gas engine revolves likewise. This spares the amateur electrician the laborious duty of pulling the wheel round in order to start. The igniter being lit, all goes merrily, and the dynamo, instead of absorbing electric energy as a motor, now commences to charge the cells, when the proper speed is attained. He places the ammeter in circuit, and notes that the normal current of 13 amperes is passing. The time now being, we will say, 8 A.M., he notes the time and curent in the diary, and an easy calculation enables him to see that the light required for that night's service will take about 60 amperes *out* of the cells ; therefore, in order to keep the cells to full efficiency, and to prevent deterioration by totally discharging them, he concludes that

$$\left.\begin{matrix}\text{65 ampere hours required}\\ \text{13 amperes charging current}\end{matrix}\right\} = 5 \text{ hours},$$

so he locks up the engine room and instructs his servant to turn off the gas at 1 P.M. exactly, which, we have seen, can be done without going into the engine room. Once a week he may have a man in for a couple of hours to clean up ; but the daily routine need not soil his hands, and the most fastidious cannot suffer, in this respect, by the exercise of a little care and the observance of a system.

Now, the first cost of such an installation may be set forth as follows:

Wiring the house for 13 lights	£10	0	0
Two switches (main)	1	5	0
Twelve branch switches	1	16	0
Two safety fuses	0	10	0
Fittings to fancy, say	10	0	0
Twenty E. P. S. accumulator cells (glass), L type	32	0	0
Shunt wound dynamo, 900 watts, with frictional driving gear	28	0	0
"Griffin" single-acting gas engine, ½ H. P. nominal, 2 H.P. indicated	55	0	0
Voltmeter and ammeter	7	0	0
Engine room fittings	10	0	0
Total	£155	11	0

Now, as regards the cost of maintenance, we will suppose the following to represent one week's record in the diary :

	Engine. Started. A.M.	Engine. Stopped. P.M.	Amperes Charging Current.	Ampere Hours' Lighting.
Monday	7:30	2:0	13	42
Tuesday	8:0	2:0	13	40
Wednesday	8:15	3:0	13	48
Thursday	8:0	1:0	13	54
Friday	7:15	4:0	13	45
Saturday	7:30	3:0	13	38
Sunday	—	—	—	42

This shows that in seven days the consumption has been equivalent to 309 ampere hours, and the charging equivalent to 520 ampere hours. Although the engine was not used on Sunday at all, we have over 100 ampere hours of charge yet to spare, so that the engine room may be silent until the following Wednesday morning.

As a matter of fact, the consumption of gas by the gas engine is really much less than would be used by the burners supplied through the meter in the usual manner, to afford an equal degree of illumination. Accumulators do not deteriorate rapidly, but will work well for many years upon such an insulation as that described, and although somewhat costly in the first instance, possesses many advantages. For instance, when systematically charged, as we have shown, the light is always available, in the sick room or for an evening party, independently of the engine, which may always be stopped on Sundays at least. A man that desires to become his own electrician may mount his hobby to his heart's content with such an installation, and may indulge in other applications of the electric current. For instance, he may drive the sewing machine, organ bellows, or a punkah, by means of small electric motors ; he may divert himself by scientific demonstrations to his friends of the uses of electricity for welding pieces of metal together (on a small scale, of course), photography at night, chemical decomposition, and hundreds of similar interesting and instructive experiments. And, considering that he may take the entire management of his installation,

and perform all the duties entailed without soiling his hands, neglecting his business, or curtailing his leisure, I am of opinion that if this were more generally known, small installations of this nature would become more generally adopted than is the case at present, and enterprising firms would soon make the supply of a complete outfit one of their specialties.*

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Oct. 10, 1890.

Prepayment Meters.—Bricks Boiled in Tar.—A Curious Accident.—Coal Gas and its Rivals.

Perhaps the most attractive item in connection with the supply of gas that is at present claiming attention is the extension of burners amongst small consumers, and the sale of gas in small quantities at a time The idea is to enter into competition with the sale of oil in small quantities, and to induce the artizan's wife, instead of spending her few cents weekly for oil, to exchange that sum for gas. Such might be managed by means of the ordinary meter and a system of weekly collections; but the preference seems to run in the direction of a prepayment automatic meter, which in return for the insertion of a penny shall deliver gas until the equivalent of that coin has been consumed, and then stop further supply until stimulated by means of another coin. Several of these contrivances are now in the market, and no doubt the ensuing season will see them tried in several places.

This is rather a healthy sign, for undoubtedly the sale of gas has been much hampered in the past by rigid adherence to the custom of "terms, quarterly," which prevails so generally that many people would be surprised at any other arrangement. No doubt the quarterly system has suited the middle class, amongst whom the bulk of gas consumers have hitherto been found; but it does not suit everybody, and, with the greater activity, restlessness, and running to and fro that obtains in these days, the class of people whom it does not suit is rapidly increasing. It is well to recognize the fact that the terms of payment, no less than the price and quality of the gas, should be adapted to the convenience of the user as far as possible; and the prepayment meter is undoubtedly an attempt to meet a generally existing need. Although nominally strict on the subject of quarterly payments, many gas companies do a good, substantial trade on what are practically half-yearly or yearly terms, amongst the upper classes of the community. And it would be well if they would adopt the customs of storekeepers, and sell upon any reasonable terms, prompt cash or long credit, that are likely to prove advantageous.

Attempts have been made from time to time to introduce a register on the ordinary meter, to indicate the actual cash value of the gas consumed. A reliable machine on this system would greatly simplify the office accounts, as, instead of taking the meter index in each case, and subsequently computing the account, the inspector would simply have a cash book in which to enter the amount due at each house, and the consumer could easily check his account. I have recently seen a simple arrangement introduced by Mr. J. L. Cloudesley, of the firm of Messrs. W. & C. Cowan, for effecting this purpose. It can be set to zero at any time, so that the cash value of the gas consumed, starting from any particular date, can be readily ascertained. In case of a change in price, the alteration can readily be arranged for, and this is a most important item in connection with any appliance on this principle. From the total amount entered on the cash book the quantity of gas sold could be easily computed, and thus the large amount of office work represented by the booking of meter indexes, copying of same on bills, subtracting and pricing the account, calling over, etc., would be entirely done away with.

A paragraph in the *American Engineer*, on the advantage of boiling ordinary bricks in tar until quite saturated therewith, reminds me of some experiments on that subject undertaken by the writer some years ago. When the advantages secured by this simple plan are more generally known, the process will be widely used. Bricks so treated will be found after drying to have increased 30 per cent. in weight, and to be much harder, unaffected by frost and acids, and perfectly waterproof. They are therefore well suited for retort house or coal shed floors, for paving the coke yard, and indeed for any purpose about a gas works. Neatly laid in black cement, they form an excellent flooring for workshops or storerooms, and, on account of their impermeability to chemical action, they are especially suited for purifying sheds, oxide floors, or sulphate houses. I have some in use just round the saturating tank, in connection with the sulphate plant, where oil of vitriol is occasionally spilt. Formerly the ordinary bricks were continually rotting and crumbling, but the tar bricks have been there for years, and are as good as when first laid. Some tar bricks put down in a place subject to continual cart traffic have also proved most durable. A purpose for which I think of trying them on the the first opportunity is for lining a tank—either a tar, liquor, or gasholder tank. If the paving course consisted of tar bricks, carefully laid in good cement, no rendering would be necessary. The report above mentioned states that the bricks should be boiled for 24 hours, but in my experiments the bricks were soaked through to the middle in 8 hours or so. The actual time required would depend on the nature of the bricks.

A remarkable accident occurred in London a few weeks since. A double railway track is crossed by a massive road bridge, composed of large iron girders supported by a brick pier in the center. Between the girders are two large gas mains, one a yard in diameter and the other rectangular and somewhat larger, being the equivalent in area of a pipe 4 feet in diameter. Against one side of the brick pier the railway people had erected a lean-to shed of timber, which was used as a naphtha store, and at the time contained 20 barrels of naphtha. It should be mentioned that the gas mains are used as trunk mains, conveying gas at high pressure for the supply of important districts of the metropolis, from the gas works situated on the outskirts of the city. In such a confined situation but little ventilation can obtain, and the atmosphere in the shed, which had been shut up for 40 hours, and that at a time when the weather was warm, became charged with inflammable naphtha vapor. The man in charge opened the stores as usual on a Monday morning, and immediately struck a match, apparently in perfect ignorance of any danger. The result was an immediate firing of the vapor and the ignition of the whole stock of naphtha, which exploded with a tremendous outburst of smoke and flame. A fire brigade was rapidly brought on to the scene, but of course was practically powerless. The great heat distorted the iron girders and caused the fracture of the two gas pipes, adding torrents of burning gas to the fury of the flames. The bridge was destroyed, stopping both the traffic on the road and the traffic on the railway. The mains are the property of the Gas Light and Coke Company, and the problem that confronted the officials in charge of that part of the plant was how to stop the fracture without admitting air into the mains, and thus forming a mixture of gas and air that might have led to most disastrous results. This was at once tackled and successfully surmounted by Mr. Foulger, the chief distribution engineer, with the assistance of a large body of men. By skillful adjustment of the valves on the lines of main, he was able to keep up the pressure on each side, whilst at the same time the large pipes were cut off and plugged, thus guarding against further danger.

The moral to be drawn from the accident is the great risk incurred by storing explosive substances in the vicinity of large gas mains. But apart from this, the fact that such a serious catastrophe as the fracture of two important conduits was met and remedied, not only without further trouble but with no inconvenience to the consumers of gas, is a most effective proof of the efficiency and skill of the Gas Company's staff. I am glad to see that this matter has not gone without public recognition on the part of the municipal authorities. An exact account of the measures adopted by Mr. Foulger and his assistants has not been published; but if a full record could be obtained it would be most instructive and interesting to all concerned in the distribution of gas, especially looking at the fact that, with the supply of electricity, steam for heating, water at high pressure for power, and other modern inventions, by means of conduits in the streets, the risk of similar accidents is certainly on the increase.

The rivals of coal gas are not having an altogether easy time. There is a noticeable tendency on the part of local authorities to use the introduction of oil, water gas, and electricity as a means of exacting more favorable terms for the public lighting of their streets, and the number of disputes on this subject are more numerous than in preceding years. This may also be due to the fact that the recent large advances in the cost of coal and labor have rendered it imperative that gas companies should increase the price charged for what, at the best, is the most unremunerative part of their business. So we find that in several places the new illuminants have been introduced, not so much on account of their intrinsic value, but as a sort of declaration of independence against the local gas company. But oil lamps will go out occasionally, or smoke, or drop oil on unoffending passers-by. The water gas works are not welcomed by people having properties or businesses in their vicinity. And the electric light has not yet dispensed with those little eccentricities for which it is now celebrated. The lights oc-

* We doubt whether a house could be properly fitted for 18 lamps for £10, and no provision is made for the cost of foundations for gas engine or dynamo. The author omits any mention of small fuses, and it is very doubtful whether any fire office would pass such an installation.

casionally flicker or are extinguished for hours together. Nor does the new venture always realize the economy that was anticipated. So that altogether there are many districts where it is found that the last state is worse than the first.

Some Practical Hints on Lubrication.

Mr. F. J. Kuhne, in *Practical Electricity*, says that the laws regulating lubrication, the action which the various articles used as lubricants have upon metals, and the chemical changes that are brought about by differences of temperature, have never received the consideration due to them. Of late years, however, they have been treated more seriously by owners of machinery. Competition among manufacturers to-day demands that the utmost caution be taken to reduce the wear and tear on the machinery, to avoid loss of time, and, above all, to save fuel. In almost every case the correct use of proper oil will be found the precaution necessary. A lubricant may apparently do good work and keep the part cool, but in reality the acids formed by the friction and heat of the journal is daily damaging the surface of the metal, and will ultimately do great damage. Consumers have for years been accustomed to rely upon the salesman, whose knowledge of the goods he sells is usually found to be very deficient. Nor can every engineer report on an oil to be relied upon; many are really ignorant, while others are personally interested. Some months ago I engaged an active and intelligent young engineer as salesman, who professed to know something about oils, and whose general ideas about lubrication seemed sensible. Upon canvassing a part of the district allotted to him with good success, so far as he went, I received a letter from him saying: "I used to think I knew something about oil, and have come to the conclusion that my knowledge will not extend beyond the outside of the barrel." This is what nine-tenths of the engineers would come to if their knowledge were put to a practical test. A good oil should be used as sparingly as the nature of the bearings will permit. On the number of revolutions a minute a machine is capable of making, and the amount of power necessary to run it, depends the amount of resistance (friction) generated by the bearings. In the use of oil uniformity of distribution is as important as the regularity of supply. A dry spot on a bearing will at once cause heating, and if allowed to continue, cutting will be the result. There is no department in a factory more important than the engine room. As the diminishing of friction will naturally result in gain of power, it is to the consumer's interest to learn by careful experiment the oils that are best adapted to run his plant, and to make the necessary tests of density, fire-test and viscosity. By so doing he can be certain to receive exactly what his machinery requires, and run it at the lowest possible cost. "Poor oils," says an eminent engine builder, "are a prolific source of injury, and often defeat the purpose for which a machine is intended." If a machine is not properly lubricated it will bind, heat and then cut, and the percentage of work added to the already overtaxed Corliss is sure to injure the engine and certainly needs an extra dip now and then into the coal pile. No oil has yet been made that can economically lubricate all the journals of a mill. An oil running a heavy Corliss engine would not do to run a spindle or a fast revolving dynamo. The former runs slowly, and has great pressure and strain on its journals, and requires, consequently, an oil which will not spread too quickly, but with low gravity and high viscosity. The latter needs a pure mineral oil, viscous and quick-spreading, to enable it to enter into the closest parts of the bearing as rapidly as the speed at which it revolves necessitates. In making an oil for a specific purpose the speed, power, pressure upon the journals, mode of application, and temperature in which it has to run should be known. This information in hand, an oil can be made to suit. Some two years ago I visited a mill and, by request, made an oil specially to lubricate an iron fan running 1,000 revolutions inside a wool dryer where the temperature was constantly kept at 280° F. This fan had been the source of great trouble on account of the pressure upon the journal and the high rate of speed while constantly subjected to such an intense heat. In addition to this it was necessary to keep the machine running for two or three weeks at a time, without a stop. At the end of a three weeks' test the bearings were found to be comparatively cool, perfectly clean and bright, while the amount of oil consumed was one-third less than any that had yet been tried. This is only one of many special cases that I can call to mind. The numerous tests that have been made by learned men at various times within the last 25 years tend to show that mineral lubricants, or compounds of mineral and animal, are the safest, and that better results are obtained from them than from any others made. I will give you the opinions of a number of authorities on the subject. Professor Thurston remarks: "Vegetable and animal oils are compounds of glycerine with fatty acids. When they become old decomposition takes place, acid is set free and the oils become rancid; rancid oil will attack and injure machinery. Mineral oil does not absorb oxygen, whether alone or in contact with cotton waste, and cannot, therefore, take fire spontaneously; animal and vegetable oils do. Mineral lubricating oils are used on all kinds of machinery; they are the safest and cheapest lubricants and are generally superior to animal and vegetable oils and greases." According to experiments by Galletry and Coleman it was found that "Mineral lubricating oils diffused through textile cotton do not take fire even at a temperature at which Colza oil ignites, and that fatty lubricants to which 20 to 50 per cent. of mineral oil was added were thereby prevented from igniting." Spon says, "A mineral oil flashing below 300° is unsafe. The best oil is that which has the greatest adhesion to metallic surfaces and the least cohesion in its own particles; in this respect, *fine* mineral oils stand first. No oil is admissible which has been purified by means of mineral acids. Mixed oil, if properly compounded, possesses the special advantages of both classes." The blending of mineral and animal oils does not merely consist in shaking them together, as is supposed by many, but, as they are of different gravity, the globules of each must be broken and run into each other by agitation and heat, so that the oil will become one body. If this is not done the animal oil will become separated, and standing in a heated room, the bad qualities will come out, and later, when used, the oil cannot do its work, and at once the quality is condemned. I had a case where a large mill owner was using oil said to be one part sperm and three parts paraffine of heavy gravity. The price was lower than I knew it could be made for. Upon analyzing a sample drawn from the barrel I found it contained 60 per cent. of sperm and 40 per cent. of paraffine showing that the oil was separating. The sperm oil being lighter was coming to the top. Such oils cannot give satisfactory results. If you have any stipulated formula have it made up for you by parties who understand the business and who have the facilities and appliances for doing it properly. Mr. Allen's experiments have shown that gumming is due to the action of free acid upon the metal bearings of machinery. The corrosion of bearings by oils has not received the attention it deserves, as the wear and tear of the metals and thickening of the oil have been attributed to other causes. Liquid oils corrode metals very evenly, so that the effect is not readily observed. Mineral oils contain no acid, unless they have been carelessly refined. Mr. I. J. Redwood says that "Mineral lubricating oil has the least action on metals, none on iron or brass. Tallow oil has most action on iron; castor, olive and lard oils have most action on brass. Rape seed has most action on copper." Greases used as lubricants, although seemingly more economical than oil, are not as saving when the greater loss by friction is considered. Before grease can begin to work, sufficient heat must be generated to melt it. In doing this the power lost will more than counterbalance what is saved on the cost of the grease. It takes about 33 per cent. more fuel to melt it by the heat produced by friction than would be required were it to be melted over a fire. Prof. Woodsbury says: "In starting machinery, before sufficient heat had been generated to melt grease, twenty times the amount of fuel is required as would be needed to melt it over a fire; even when the melting point has been reached the friction is 33 per cent. greater than when the machinery is lubricated with a suitable proportion of mineral oil."

Natural Gas Companies and Their Reported Profits.

According to the reports filed with the Auditor General of Pennsylvania, by the natural gas companies of that State, the following balances for the year are returned:

The report of the Western Pennsylvania Natural Gas Company, of Pittsburg, shows that for the past year no dividend has been declared; their capital stock is $5,000, on the appraised value of which, $500, was levied a tax of 3 mills. The Torrens Gas Company, with a capital stock of $15,400, declared no dividends during the past year; the appraised value is $5,120, on which was levied a tax of 3 mills. The People's Natural Gas and Pipeage Company, of Pittsburg, have a capital of $300,000. On January 10, March 18, June 17 and September 16, 1889, a dividend of 2 per cent. was declared. The gross earnings of the year were $60,608.88; the net earnings, $46,675.38. The Westmoreland and Cambria Natural Gas Company have a capital of $2,000,000; 2½ per cent. dividends were declared four times during the year. The Versailes Fuel Gas Company have a capital stock of $250,000; no dividends were declared last year, as the Company did no work. The Fort Pitt Natural Gas Company have a capital stock of $250,000; no dividend was declared last year; there was a loss of $3,357.54. The Meadville Natural Gas Company of Oil City, have a capital stock of $100,000; four

dividends of 1½ per cent. were declared. The Fayette City Natural Gas Company have a capital stock of $10,000; an 8 per cent. dividend was declared last year; the gross earnings were $4,501.24; net earnings, $1,347.79. The Independent Natural Gas Company, of Butler, have a capital of $10,000; no dividend was declared.

The Kitanning Consolidated Natural Gas Company have a capital stock of $135,000; three dividends of 1 per cent. were declared. The Carpenter Natural Gas Company have a capital stock of $10,000; surplus for the year, $2,933.33; no dividend declared. The Ten Mile Oil and Gas Company, of Washington, Pa., have a capital of $25,000; no work was done last year. The Meadville Fuel Gas Company, of Washington, Pa., have a capital of $100,000; dividends of 1½ per cent. were declared last year. The Bellevue Natural Gas Company, capital stock $50,000, was consolidated last year with the Bellevue and Glenfield Natural Gas Company. The Tionesta Gas Company have a capital of $50,000; gross earnings for the year, $5,668.16; net earnings, $2,222.86; no dividend declared. The Manufacturers Gas Company, of Pittsburgh, have a capital of $600,000; gross earnings for the year, $207,612.90; net earnings, $123,328.86; no dividend declared. The Greenville Natural Gas Company have a capital of $50,000: did no business last year. The Youghiogheny Natural Gas Company have a capital of $180,000. A dividend of 6 per cent. was declared. Gross earnings, $21,169.99; net earnings, $12,867.57.

The Natural Gas Company, of West Va., of Pittsburgh, have a capital of $1,000,000; a 4½ per cent. dividend was declared. Net earnings for the year, $45,000. The Southern Natural Gas Company, of Pittsburgh, have a capital stock of $1,000,000. No business has been done as yet. The Duquesne Natural Gas Company have a capital stock of $10,000; gross earnings for last year, $19,644 26; net earnings, $16,992.15; no dividend declared. The Bellevue and Glenfield Natural Gas Company have a capital of $70,000; no dividend declared last year. The Northwestern Natural Gas Company, of Oil City, have a capital of $265,000; four dividends of 1½ per cent. each were declared. The Keystone Natural Gas Company, of Parkers, have a capital of $10,000; a dividend of 6 per cent. was declared; gross earnings, $14,529.41; net earnings, $3,374.65; undivided profits, $5,050.20. Lock No. 4, Natural Gas Company, capital, $5,000; a dividend of 6 per cent. was declared. Taylorstown Natural Gas Company, of Pittsburgh, capital, $100,000; no business done during the year. Brownsville Natural Gas Company, capital, $65,000; a dividend of 2 per cent. was declared; gross earnings, $8,002.61; net earnings, $5,520.33. The Independent Natural Gas Company, of Sewickley; capital stock, $40,000; no dividend declared during the year.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. WILLIAM CARTWRIGHT, who for many years acted as manager of the Oswego (N. Y.) Gas Light Company, has been elected President of the Northern Liberties Company, of Philadelphia, Pa. We congratulate Mr. Cartwright on the fact that he is again actively in the field.

THE Badger Illuminating Company, of Milwaukee, Wis., has been absorbed by the North American Company, of this city, a corporation that traces its paternity to Henry Villard and associates, of Oregon Transcontinental Railway fame.

THE proprietors of the Kansas City (Mo.) Gas Light and Coke Company have issued the following commonsense circular to their consumers, and also caused the same to be printed in the columns of the leading local newspapers: "At this season of the year, owing to local causes, there is a possibility of some of our customers having to complain of poor light, which is usually occasioned by the gas service pipes leading into the houses becoming partially stopped—due mainly to variations in the temperature. The difficulty being strictly local, we can learn of it only through our customers, whom we urge to promptly notify us whenever the light shows signs of diminishing, and we shall take pleasure in as promptly correcting the evil. Please bear in mind that when the light once gets poor on account of stoppage in pipes, it will continue to grow worse until something is done, and our customers should not, therefore, wait a day after the defect is first observed before sending us word. It is also advisable to notify us as early in the day as possible. We shall esteem it a favor on the part of our patrons if they will at all times bring to our notice any cause of complaint." Invitations and suggestions of this nature, especially when given or made well in advance of the time in which the defects are likely to manifest themselves, cannot fail to result in mutual benefit, and are also certain to cultivate a better feeling between the parties in interest.

THE Illinois Gas and Ice Company, capitalized in $500,000, has been incorporated at Chicago, by Messrs, E. G. Hall, E. L. McAuliff and L. E. Douney. Among other things, the Company proposes "to manufacture gas for fuel and illuminating purposes."

PRESIDENT LINDENBERGER, of the Kentucky Rock Gas (natural) Company issued a circular call for a meeting of the bondholders (which was held in Louisville last Tuesday), and the result of the conference—it was held for the purpose of discussing the present status of the affairs of the Company and the probable course of the litigation now pending in the United States Circuit Court for the district, and to protect the interests involved, etc.—cannot be said to have been very reassuring to the bondholders. The trouble is, in all probability, that no satisfactory or concerted action can be taken until President Lindenberger will listen to the voice of reason. His resignation would likely be accepted.

MESSRS. BARTLETT, HAYWARD & CO., of Baltimore, we understand, have secured the contract for the new gas works that is to replace the old Annapolis (Md.) plant.

AT the annual election of the Conshohocken (Pa.) Gas Light Company, the following officers were chosen: President, Frederick Light; Secretary, Harry M. Tracey; Treasurer, Wm. McDermott; Directors, Howell Jones, Richard H. Bate, J. T. Baker, Frederick Light and Harry M. Tracey.

MR. GEORGE KENDALL, who at one time was prominently identified with the Grand Rapids (Mich.) Gas Company, died, at his home in that city, on the morning of the 17th inst. Deceased was born in Greenfield, Franklin county, Mass., on December 1, 1813, and received a thorough business training in the Greenfield Academy. In 1836 he traveled through Michigan, engaging in business ventures at Kalamazoo and Otsego, but finally (in 1849) located himself at Grand Rapids. Here he purchased an outlying plot of 76 acres, and under the name of Kendall's Addition, the plot subsequently became a part of the city of Grand Rapids. He was a keen business man, and was interested largely in the furniture manufacturing firms of the district. He was much esteemed by his fellow townsmen, and was prominent in the direction of their civic affairs.

WORK has been commenced on the gas plant for Huron, South Dakota, the franchise for which is held by the South Dakota Gas, Light and Heat Company. The proprietors promise that the plant will be in working order by January first.

MR. J. H. MILLER, JR., of Fort Wayne (Ind.) has charge of the negotiations that are likely to result in the transfer of the works and franchises of the Galena (Ills.) Gas Light Company to an Eastern syndicate.

WORK on the auxiliary water gas plant that is being constructed at Pittsfield, Mass., by the United Gas Improvement Company, is well underway. Mr. Westcott has charge of the construction for the contractors. Messrs. Deily & Fowler, of Philadelphia, are putting up the holder.

MR. THOMAS F. ROBINSON has been awarded a franchise for the construction and operation of a gas works at Marshall, Minn. He proposes to employ the system that is in vogue at Jackson, Mich. Under the agreement Robinson is to commence construction work within 60 days after the ordinance is signed, and the system is to be completed not later than June 1st, 1891. The grant is to last for 20 years, and, according to the language of the ordinance, Robinson is to furnish "gas for the lighting of the public streets of said village, along the line of the gas pipes as laid by him, and at the lowest practicable price per 1,000 cubic feet." The terms of the contract as to price that may be charged are, it seems to us, sufficiently elastic.

MR. CHARLES J. LEWIS, Superintendent of the Hannibal (Mo.) Gas Company, has been authorized by the proprietors to make the following announcement, as an earnest of the Company's desire to serve the public faithfully and well. "Under the management of the present ownership of the Hannibal gas works there have been, since January 1st, 1880, two voluntary reductions in the price of gas. I now take pleasure in announcing to our present customers, and to the many other citizens who, we hope, will by this action be induced to become our patrons, that another and important reduction has been determined upon. Commencing with the present month (October) the price of illuminating gas will be $2 per 1,000 cubic feet, with he present conditional discount of 5, 10 and 15 per cent.—making the net cost to the consumer, $1.90, $1.80 and

$1.70 per thousand, according to the amount used; and the price of gas used for fuel (cooking, heating, etc.), when supplied by a separate and independent meter, will be $1.50 per thousand, net. These reductions will make a serious inroad upon the receipts of the Company, and its business success can now be maintained only by a commensurate increase of patronage, which it sincerely hopes will follow. It can now be truthfully said that in no other Western town of similar population and in which a like quantity of gas is used, is the price of manufactured gas cheaper than in Hannibal. Thanking the people for their kindness and liberality in the past, and confidently relying upon a merited continuance of the same, I am, respectfully, C. J. LEWIS, Supt."

THE Worcester (Mass.) *Times*, of the 16th inst., says, anent the proposed consolidation of the interests of the local Gas and Electric Lighting Companies; "There is every reason to believe that the State Board of Gas and Electric Lighting Commissioners is not satisfied with the reports of the Gas Company and the Electric Light Company of this city, which Companies propose to consolidate as soon as the State Board gives its consent. The Gas Company, it will be remembered, proposes to buy out the electric light people, giving the latter 2,000 shares in the consolidated Company as an equivalent for the $200,000 of capital which the electric light plant represents, and at the hearing in the Court House, on October 9th, both parties to the consolidation presented statements unsworn to but made unreservedly, that it will be in the best interest of the city to have one Company furnish both electric and gas lights. The State Board has not as yet examined the Superintendents of either Company, and the officials of neither have been notified that the proposed consolidation is likely to be sanctioned, and it is intimated that the delay in expressing an opinion, one way or another, is due to the fact that the Board is decidedly dissatisfied with the result of the hearing. 'I cannot say anything positive about the matter,' a *Times* informant said this morning, 'but in a general way I think it will shortly be made publicly known that the Commission is not entirely satisfied with the books of the Companies, though whether it is of one or both I cannot state. But one thing is almost sure, the Commission will not agree upon a consolidation of the two Companies unless a more satisfactory showing can be obtained than has been presented. In any event no report will be made for several days."

THE above speculations of the *Times* man should be taken as mere speculation and nothing else; for it is quite outside the pale of probability that the Commission or any of its attaches has even hinted what its decision was to be; nor do we think that the delay in announcing an opinion is to be construed in any sense as showing or evidencing a leaning to an adverse decision to the proposed consolidation on the part of the Board. The reasons given by both companies for favoring a combination of their respective interests were furnished without hesitation or reserve, and amount to nothing else than a statement that the public can be better served more cheaply with a supply of light if the business of such supply be placed under one control. Consolidation means the lopping off of dual expense, and in that understanding the amalgamation at Worcester is arranged for.

THE following is the text of the resolution offered by Councilman Humphreys to the local Council in respect to the construction and operation of an electric lighting plant on municipal account at Kansas City, Mo.:

Whereas, The accompanying statement, if found upon investigation to be correct, shows that Kansas City should own her own lighting plant; therefore, be it

Resolved, By the lower house of the Common Council, the upper house concurring therein, that a joint committee of two from each house be appointed to investigate the advisability of issuing bonds for said purpose, and also the feasibility of placing said plant in the subbasement of the new city hall. And be it further

Resolved, That in the event of a favorable report on said issue of bonds the committee be requested to suggest a time for holding said election, and, if possible, name a date upon which there can be a joint election upon charter amendments and issue of bonds.

From the figures submitted in the "accompanying statement," it appears that Mr. Humphreys concludes that an investment on plant account of $198,500 would be sufficient to light the city completely by electricity, and that $42,563 would be the cost annually of maintaining and operating the supply, the latter sum also to cover interest on bonds issued on construction account.

AT the annual meeting of the Milford (Mass.) Gas Light Company the following officers were chosen: President, C. F. Claflin; Treasurer, B. E. Harris; Secretary, L. H. Cook; Directors, C. F. Claflin, J. B. Bancroft, B. E. Harris, L. H. Cook, I. N. Davis, N. B. Johnson, E. L. Wires, F. J. Dutcher, Jas. E. Walker and Geo. A. Draper. The reports for the year were extremely satisfactory, and show that gas lighting more than holds its own in this busy Bay State borough.

THE proprietors of the old Willimantic (Conn.) Gas Company have agreed to dispose of their property to the newly-formed Citizens Gas Company, the latter to take possession on the 15th prox.

CONTRACTOR MORRISSEY has begun work on the main laying contract recently awarded him by the proprietors of the new Gas Company for New Utrecht, L. I. The leading main is to run through Fort Hamilton avenue, and a 16-inch pipe is to be put down.

ARTICLES incorporating the Texarkana (Arkansas and Texas) Gas and Electric Railway Company have been filed. The capital stock is placed at $500,000, and the officers are: President, J. H. Deutschman; Vice-President, Benjamin Collins; Secretary, H. N. Offenhauser. The Company propose "to buy, construct and maintain a system of gas and electric lights, railways, etc."

THE St. Clair Light and Fuel Company, of Port Huron, Mich., seems to be bankrupt, in that executions for judgments, obtained by the American Tube and Iron Company, of Pittsburgh, Pa., for $3,765.61 and $3,765.11 respectively, have been returned bearing the sad indorsement, "no goods." The leaves are falling in these dull October days, and the various fuel gas projects, that were born of wind and gale some months ago, appear to be joining in the rustle. Perhaps the leaves will cover them from the snows of financial distrust.

MISS ANNIE L. FENWICK is now Mrs. Sanford N. Whitewell, the marriage services having been celebrated at the Church of the Covenant, Washington, D. C., on the 15th inst. The groom is a popular attache of the Washington (D. C.) Gas Light Company.

STILL another echo of the wedding bells comes to us from Jacksonville, Fla., in which place, on the afternoon of the 9th inst., Miss Estelle Strawn was united in marriage to Mr. Arthur Perry, the energetic Secretary of the Jacksonville Citizens Gas and Electric Light Company.

THE Gallatin (Tenn.) Gas Company and the local authorities have settled their differences over the public lighting, and gas will be the street lighting agent there for another year.

THE Greenville (Texas) City Council has determined to install an electric lighting plant, to be operated on municipal account, and the Mayor now asks for bids on a plant rated to supply 25 arcs, of 2,000-candle power each, and 200 incandescents, of 16-candle power each. Nine miles of wire circuits, a 100 horse power engine and two 50-horse power boilers are to form portions of the equipment. The competition is to terminate on the 10th prox.

C. STRATTON has instituted suit against the Macon (Ga.) Gas Light and Fuel Company (it also controls the water supply) for damages in the sum of $10,000. He alleges that he has been injured in that amount through the action of defendant in tapping certain springs of water which he had reserved for his own use and benefit.

THE Bay State Gas Company has decided to pay 3½ per cent. on the income bonds on Nov. 1. The books were closed last Saturday, to be reopened on Saturday next. Holders of bonds payable to bearer must either register or present the bonds in person to receive the interest payment. The amount to be paid on this account at that rate foots up $140,000 per annum.

THE Travelers Insurance Company, of Hartford, Conn., has loaned $40,000 to the Hartford City Gas Company. The money is to be applied to the payment of contracts on account of plant extensions.

THE Fire and Gas Committee of the Toronto City Council have at last agreed upon a basis for the award of the public lighting contracts in that city. The determinations are:

Toronto Electric Light Company, for the supply of from 800 to 1,200 arc electric lights, for 5 years, at 29¼ each per night.

Consumers Gas Company, for the supply of a minimum of 1,000 lamps, with 4-foot burners, on the present lines of mains, in such localities as may be required by the city, at $21.50 each per post per annum; Lambeth lamps at $75 each per annum; and such lamps as may be re-

quired on new mains, a distance of 150 feet apart, at $23 each for lamps with 4-foot burners and $75 each for Lambeth lamps. The Gas Company agrees to erect lamps in lanes running off streets where gas mains have not been laid, upon the city paying the cost of laying the extra pipe required in excess of 150 feet. This is a substantial victory for Mr. Pearson and his associates.

If the query is a pertinent one, it might be in order to ask what is the annual cost of maintaining the "Literary Bureau" to the home Thomson-Houston Company? The staff seems to direct its attention chiefly to the preparation of attractive financial articles, that appear with somewhat monotonous regularity in a select few of the Boston dailies, all tending to show what a good thing the common stock of the parent Company is. It may be a "good thing," but, then, so many "good things" go wrong.

Argument was begun, in the Supreme Court of Missouri, on the 16th inst., upon the mandamus proceedings instituted by the city of St. Louis against the Laclede, Carondelet, and Water Gas Companies. City Attorney Bell argued the case for the city, Messrs. Madill, Adams and Bond appearing for the gas interests. The proceeding seeks to compel the Gas Companies to pay due heed to the city ordinance limiting the price of gas in St. Louis to 90 cents per 1,000 cubic feet. The Companies contend that the city had no right to pass such an ordinance in view of the prior ordinance of 1885, under which they contracted to charge not to exceed $1.25 per 1,000. The Companies are charging only $1.18, net. No matter how the Supreme Court decides, the case will go to the United States Supreme Court, on the question of constitutionality.

The officers chosen by the Troy (N. Y.) Gas Company through its Trustees, are: President, Edward Murphy, Jr.; Vice-President, William Kemp; Secretary, C. E. Davenport; Treasurer, Derrick Lane.

The Massachusetts Fuel Gas Company, to operate in Chelsea, Mass., is capitalized in $100,000, and its officers are: President, William Butterfield; Vice-President, E. C. Gaffield; Secretary, John H. Roberts; Treasurer, William Martin; Directors, William Martin, Peter S. Roberts, E. C. Gaffield, William Butterfield, John H. Roberts, D. C. Day and Wilbur L. Libbey.

There is rumor of an opposition Company for Brooklyn, N. Y.

We are indebted to a correspondent for the following interesting particulars respecting the history of the Jacksonville (Ills) Gas Light and Coke Company: "The substantial and extensive improvements being made by the Jacksonville Gas Light and Coke Company are attracting much attention in that city, hence a brief recital of the history of the organization that controls the lighting supply of the place may not be without interest to your readers. The Company was organized February 28th, 1857, at that time all the stock being held by Messrs. M. P. Ayers, J. O. King and James Berdan. On June 11th, 1857, the follow- Directors were elected: W. Thomas, Alex. McDonald, Ed. Gwyn, Jos. O. King and M. P. Ayers. Mr. Ayers was elected President (he still holds the same position), Alexander McDonald was chosen Secretary, and Joseph O. King was appointed Treasurer. On the same day a contract was made with Edward Gwyn to construct the gas works. Three miles of gas mains were laid, and on June 11th, 1858, the works were accepted and gas was turned on. February 6, 1858, Edward Gwyn tendered his resignation and Nimrod Dewees was named to succeed him. At that time J. O. King was elected Superintendent, a position which he held until his death. At that time gas was sold at $5 per 1,000 cubic feet. May 1st, 1886, Isaac D. Rawlings was elected a Director. Owing to the imperfect construction of the works it became necessary to spend all the earnings of the Company and borrow largely in addition to make the business a success, hence for 15 years the stockholders received no dividends on their shares. The tribulations of the Company during those 15 years were known only to those who were in its management, and it is a singular fact that not one of those who were Directors at that time is now living, except Mr. M. P. Ayers, who, as has been remarked, has been the President since the beginning. The present Board of Directors is composed of Messrs. M. P. Ayers, President; F. M. Doan, Superintendent and Secretary; Frank Elliot, Auditor; Isaac Rawlings, John Bellate and Ed. S. Greenleaf. Thousands of dollars have been expended in improving the works, until at this time there are 27 miles of mains, about 800 consumers, and the price of gas is $2 for lighting and $1.50 for heating and cooking. Were it not for the disproportion in the number of consumers to the miles of pipe, the price would be reduced still more. The Company is still working toward cheaper gas, and with that end in view is now expending $15,000 in a holder, 70 feet diameter and 20 feet high, which, in connection with the two old ones, will give abundant storage capacity and enable the Company to maintain the high standard of gas which it sells. Nearly 200 gas cooking stoves are now in use, and this number bids fair to increase to 300 by another year. All of the stock is held by citizens of Jacksonville, and of the 58 stockholders 28 are ladies, who have bought it in order that they might draw their dividends, which have been for several years 3 per cent. semi-annual. In June, 1885, the Company purchased the remains of the Vandepoele Electric Light Company, and since that time has operated the electric light department in connection with the gas works. The Thomson-Houston arc system and the Westinghouse incandescent are represented by four arc dynamos, about 80 lamps, and one incandescent dynamo by 750 lamps. In order to increase the efficiency of the works the Company has bought adjoining lots and are now building houses for their operatives so as to have them near by. But the largest expenditure being made is the new gasholder which will hold 57,000 cubic feet of gas, which, in connection with the two old ones, will give a capacity of about 125,000 cubic feet. In order to meet the expense of so many improvements and to purchase other electric light machinery the Company is going to put a 5 per cent. bond on the market to the amount of $50,000."

Progress of the Gas Engine.

According to a Manchester contemporary, Messrs. Crossley Bros., of Openshaw, the well known gas engine makers, have made a new development in the manufacture of large gas engines. This is in the form of the completion of a new 30-horse power single cylinder "Otto" gas engine, possessing a capability of working up to 100 horse power. All the latest improvements are included in the engine, which is erected on the horizontal plan, and is intended for the Wandsworth Projectile Company, of London. This engine is, however, by no means the largest manufactured by Messrs. Crossley. The double cylinder "Ottos" are now well known among manufacturers and others for possessing many advantages over the ordinary steam engine. Engines of this character are made capable of running up to from 100 to 200-horse power. The firm has now in hand several large installations, requiring from 100 to 500-horse power in each case. One of the latter installations will consist of several double cylinder engines, and will be used for driving the machinery of a large flannel manufactory. The use of gas engines for this work is a new departure; for it has hitherto been supposed that these engines were not powerful enough for driving machinery on a large scale. The order will be the largest that has ever been placed for engines of this description. With the engines laid down by Messrs. Crossley Bros. is connected the Dowson patent economic gas system, which, in conjunction with the engine, brings down the fuel consumption to less than 1¼ pounds per indicated horse power per hour. This result has perhaps elsewhere never been arrived at, even by the best and most modern Lancashire mill engines. The machinery in Messrs. Crossley's works has for several years past been entirely driven on this system; and the actual cost of working has never exceeded the above figures. Extensive use of the engines is also made at the works of Sir William Armstrong, limited, at Elswick. There are about 1,000 engines made by the firm at present working in Manchester, and Messrs. Crossley not unfairly assert that as a result they have practically aided in the important work of improving the state of the atmosphere of the district. With the production of the latest single cylinder engine, the firm are now able to provide some 25 varieties of engines.

Gas and Vapor Burners.

English letters patent (No. 5,293) have been granted to W. Welch, of Portsmouth, for advances in the construction and equipment of gas burners for producing a more perfect combustion and incandescence in the use of coal, water and oil gases, and in destroying the noxious and deleterious effluvium arising in the burning thereof. The claims made for the invention are: "1. The construction of expansion chambers or spaces within the interior of the burners for increasing the volume of the gases after entry from the supply pipe. 2. The filtration or purifying of the gases within the burners by passing through granular, or porous, or vacuous medium of similar or dissimilar substances, whereby disintegration is attained previous to passing to the surface of ignition, and producing greater incandescence. 3. The superheating the gas previous to coming in contact with the atmospheric air, by passing through heated fireproof or porcelain surfaces. 4. Preventing the escape of noxious effluvium, by the expansion, filtration, and superheating the surface of ignition, without being in contact with heated iron or metal pipes and surfaces."

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AGENTS.
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MONDAY, OCTOBER 27, 1890.

The Market for Gas Securities.

The market for city gas shares was fairly firm during the week, Consolidated selling above par to 101¼. To-day (Friday) opening sales were made at 101, and the outlook is for higher prices. Mutual and Equitable are steady to strong, with but little stock offering. Brooklyn shares show no decided change, save in respect to Citizens, which this week crossed the par line. Opening quotations in it to-day were 99½ to 100. This announcement was made last Monday: "The Fidelity Insurance, Trust and Safe Deposit Company (Phila) will distribute, through the Central Trust Company, of New York, on and after October 30, to stockholders of record, October 22, of the Chicago Gas Company, an amount equal to 1 per cent. of the par value of their holdings." Transfer books of the Company will remain closed from Oct. 22 to Oct. 31. Shares in the Company are somewhat weaker, at 40½ ex. Bay State gas is offered at 74, and Laclede sold to day at 17½. The Lawrence (Mass.) Gas Company has filed a bond with the American Loan and Trust Company, of Boston, to secure a mortgage of $200,000.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

OCTOBER 27.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	100⅞	101
Central	500,000	50	90	100
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	124	126
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	—
Mutual	3,500,000	100	120	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	85	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	119	122
Citizens	1,200,000	20	99½	100
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	134	—
" Bonds	300,000		10	105
Peoples	1,000,000	10	—	95
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	108	110
Nassau	1,000,000	25	133	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	129	132
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	70	74
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	40½	—
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	—	92½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	—	30
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt	11,000,000	100	50	51
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	170	175
Louisville, Ky	2,570,000	50	125	130
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	17½	18
Preferred "	2,500,000	100	52½	55
Bonds	9,034,400	1000	78	78½
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			35	36
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100
Syracuse, N. Y	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal	10,000,000	100	59	59½
Washington, D. C	2,000,000	20	200	208
Wilmington, Del.		50	88	90

Advertisers Index.

GAS ENGINEERS. Page
Jos. R. Thomas, New York City ... 601
Wm. Henry White, New York City ... 607
Wm. Mooney, New York City ... 601
Fred. Bredel, N. Y. City ... 603

CHEMISTS.
Durand Woodman, New York City ... 591

GAS AND WATER PIPES.
Gloucester Iron Works, Phila., Pa ... 601
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 601
Ohio Pipe Co., Columbus, Ohio ... 601
M. J. Drummond, New York City ... 601
R. D. Wood & Co., Phila., Pa ... 603
Warren Foundry & Machine Co., New York City ... 601
Donaldson Iron Co., Emaus, Pa ... 601
Dennis Long & Company, Louisville, Ky ... 601
Spiral Weld Tube Company, New York City ... 601

GAS WORKS APPARATUS AND CONSTRUCTION.
James R. Floyd & Sons, New York City ... 607
Continental Iron Works, Greenpoint, L. I ... 607
Delly & Fowler, Phila., Pa ... 607
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 604
Stacey Mfg. Co., Cincinnati, Ohio ... 607
Bartlett, Hayward & Co., Baltimore, Md ... 605
Morris, Tasker & Co., Limited, Phila., Pa ... 605
Davis & Farnum Mfg Co., Waltham, Mass ... 604
R. D. Wood & Co., Phila., Pa ... 603
Bouton Foundry Co., Chicago, Ills ... 607
Isbell-Porter Company, New York City ... 606
Fred. Bredel, N. Y. City ... 603
United Gas Improvement Co., Phila., Pa ... 597
National Gas Light and Fuel Co., Chicago, Ills ... 598
Berlin Iron Bridge Company, East Berlin, Conn ... 483

PROCESSES.
National Gas Light and Fuel Co., Chicago, Ills ... 598
Bartlett, Hayward & Co., Baltimore, Md ... 605
United Gas Improvement Co., Phila., Pa ... 597
The American Gas, Light and Heat Co., Phila., Pa ... 591

INCLINED RETORTS.
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 556

GASHOLDER TANKS.
W. C. Whyte, New York City ... 598
J. P. Whittier, Brooklyn, N. Y ... 599

GASHOLDER PAINT.
The Government Waterproof Paint Co., Boston, Mass ... 598

RETORTS AND FIREBRICK.
J. H. Gautier & Co., Jersey City, N. J ... 602
B. Kreischer & Sons, New York City ... 602
Adam Weber, New York City ... 602
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 602
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 602
Borgner & O'Brien, Phila., Pa ... 602
James Gardner, Jr., Pittsburgh, Pa ... 602
Henry Maurer & Son, New York City ... 603
Chicago Retort and Fire Brick Co., Chicago, Ills ... 602
Baltimore Retort and Fire Brick Co., Baltimore ... 602
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 602
Boston Fire Brick Works, Boston, Mass ... 602

SCRUBBERS AND CONDENSERS.
G. Shepard Page, New York City ... 595
R. D. Wood & Co., Phila., Pa ... 600

REGENERATIVE FURNACES.
Bartlett, Hayward & Co., Baltimore, Md ... 603
Fred. Bredel, New York City ... 603
Chicago Retort and Firebrick Co., Chicago, Ills ... 602
J. H. Gautier & Co., Jersey City, N. J ... 603
Adam Weber, New York City ... 594

GAS GOVERNORS.
Connelly & Co., New York City ... 599
Fred. Bredel, N. Y. City ... 603
Friedrich Lux, London, England ... 594
Wilbraham Bros., Phila., Pa ... 599

SELF-SEALING MOUTHPIECE DOORS.
Ibsell-Porter Company, New York City ... 606
James R. Floyd & Sons, New York City ... 600

TAR AND CARBONIC ACID EXTRACTOR.
Geo. Shepard Page, N. Y. City ... 596

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y. ... 602

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 608

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 610
American Meter Co., New York and Philadelphia ... 611
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa. ... 611
Helme & McIlhenny, Phila., Pa. ... 611
D. McDonald & Co. Albany, N. Y. ... 611
Nathaniel Tufts, Boston, Mass. ... 610
Maryland Meter and Manufacturing Co., Baltimore, Md ... 591
Jones Meter and Stove Co., Royersford, Pa. ... 610
Harris Bros. & Co., Philadelphia, Pa. ... 610

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 592
Isbell-Porter Company, New York City ... 606
Wilbraham Bros., Philadelphia, Pa. ... 599
Connelly & Co., New York City ... 599

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 609
Perkins & Co., New York City ... 608
Despard Coal Co., Baltimore, Md ... 609
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 609
Westmoreland Coal Company, Phila., Pa ... 609
J. & W. Wood, New York City ... 608

CANNEL COALS.

Perkins & Co., New York City ... 608
J. & W. Wood, New York City ... 608

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 592
John McLean, New York City ... 592
Chapman Valve Manufacturing Co., Boston, Mass ... 592
R. D. Wood & Co., Phila., Pa. ... 606
The P. H. & F. M. Roots Co., Connersville, Ind. ... 556

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 576
Clerk Gas Engine Co., Phila., Pa ... 609
Van Duzen Gas Engine Co., Cincinnati, Ohio. ... 609

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass ... 599

STEAM PUMPS.

Van Duzen & Tift, Cincinnati, Ohio ... 592

GAS LAMPS.

Welsbach Incandescent Gas Light Co., Phila., Pa. ... 593
The Siemens-Lungren Company, Philadelphia, Pa. ... 593
Fiske, Coleman & Company, Boston, Mass. ... 602

PURIFIER SCREENS.

John Cabot, New York City. ... 594
Bartlett, Hayward & Co., Baltimore, Md. ... 594

GAS STOVES.

American Meter Co., New York and Philadelphia ... 595
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 612
George M. Clark & Company, Chicago, Ills. ... 594
D. McDonald & Co., Albany, N. Y. ... 611
Maryland Meter and Manufacturing Co., Baltimore, Md. ... 591
Jones Meter and Stove Co., Royersford, Pa. ... 610
Chicago Gas Stove Company, Chicago, Ills. ... 594

STREET LAMPS.

J. G. Miner, Morrisania, New York City. ... 557
Bartlett Street Lamp Man'fg Co., New York City. ... 593

BURNERS.

C. A. Gefroner, Phila., Pa. ... 608
Moses G. Wilder, Phila., Pa. ... 593

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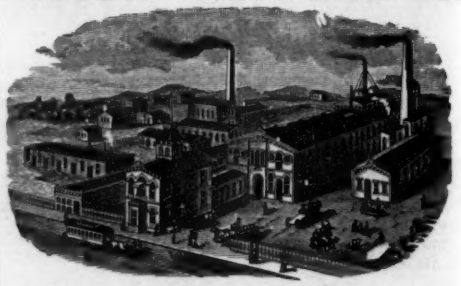

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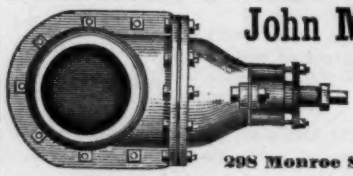

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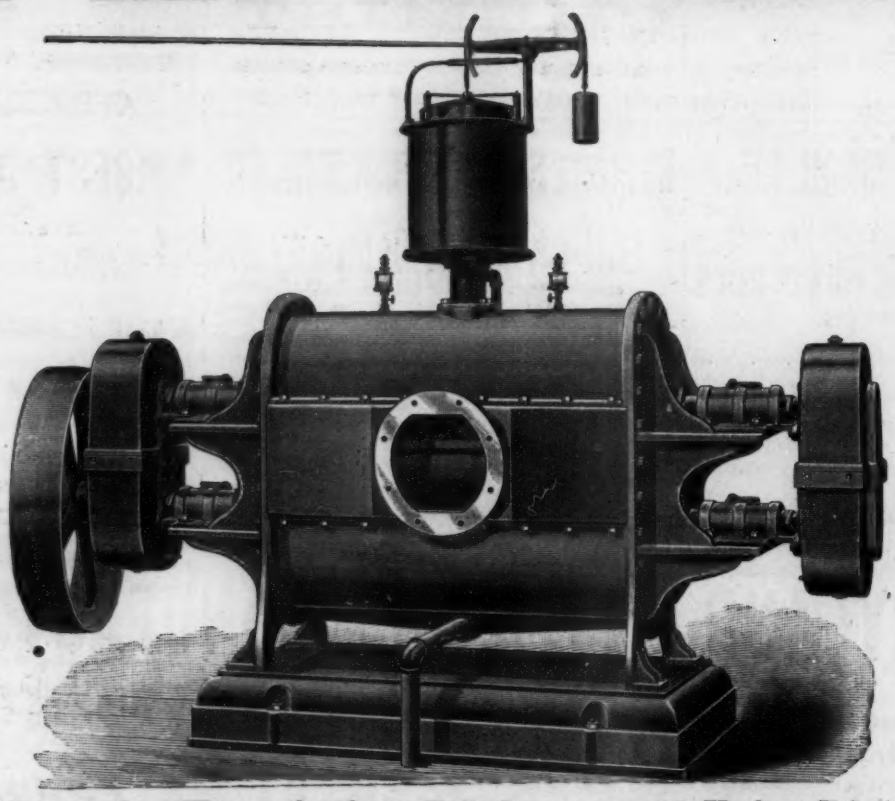

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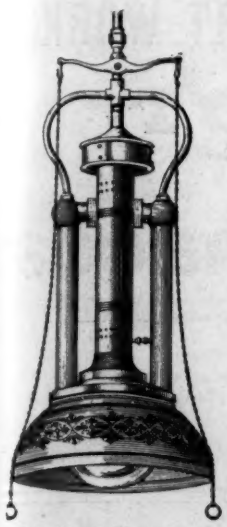
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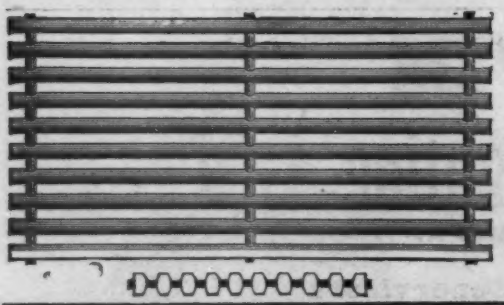

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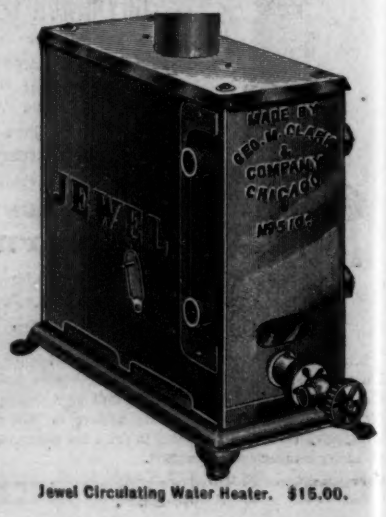

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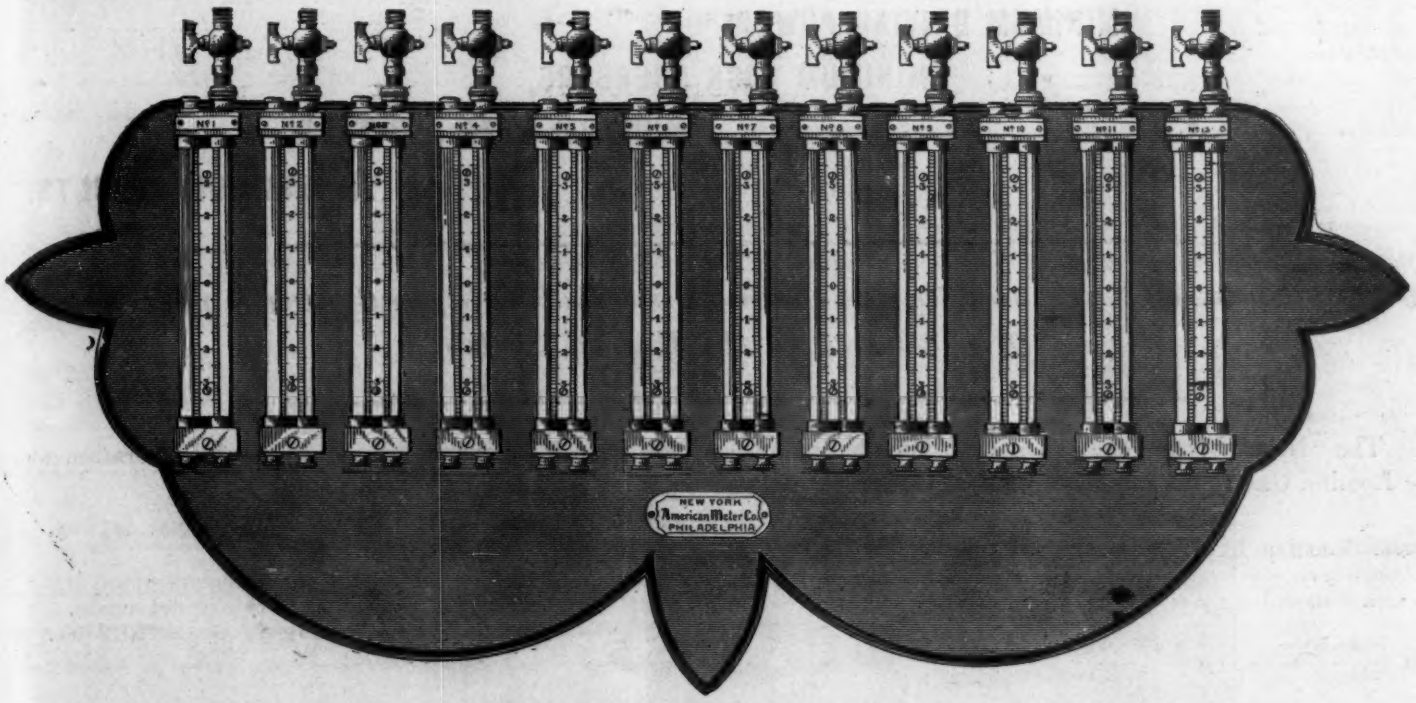

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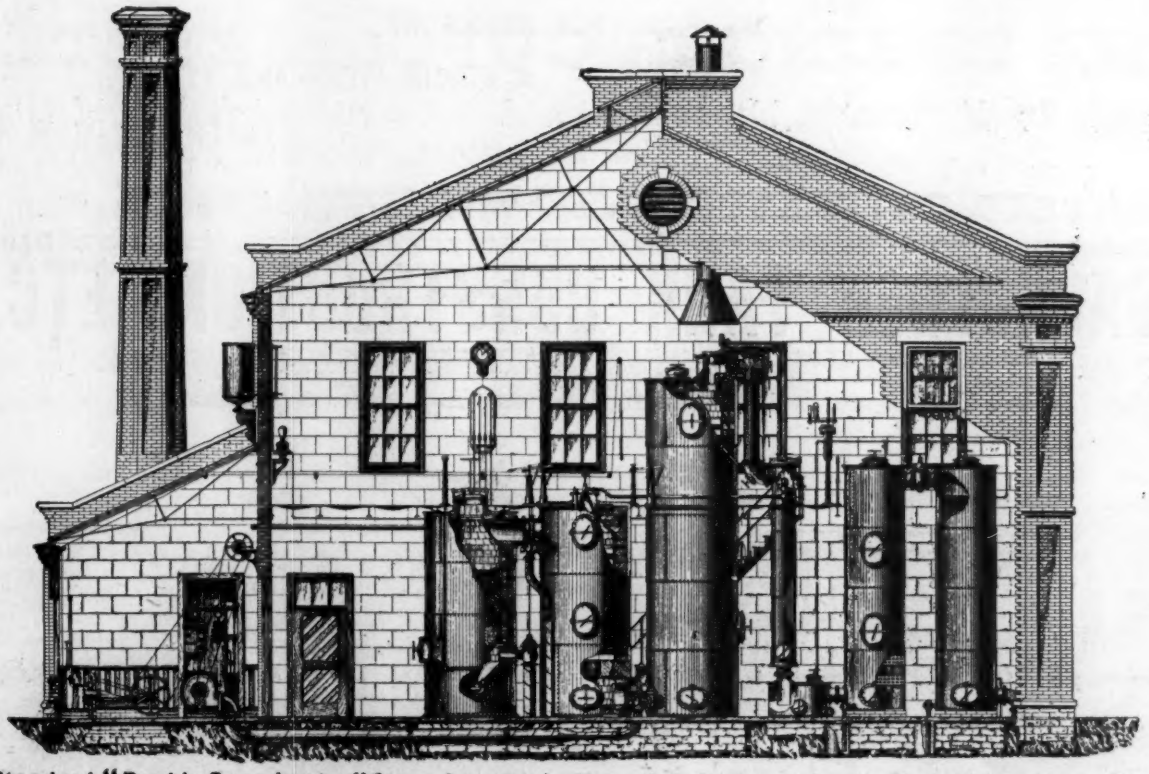

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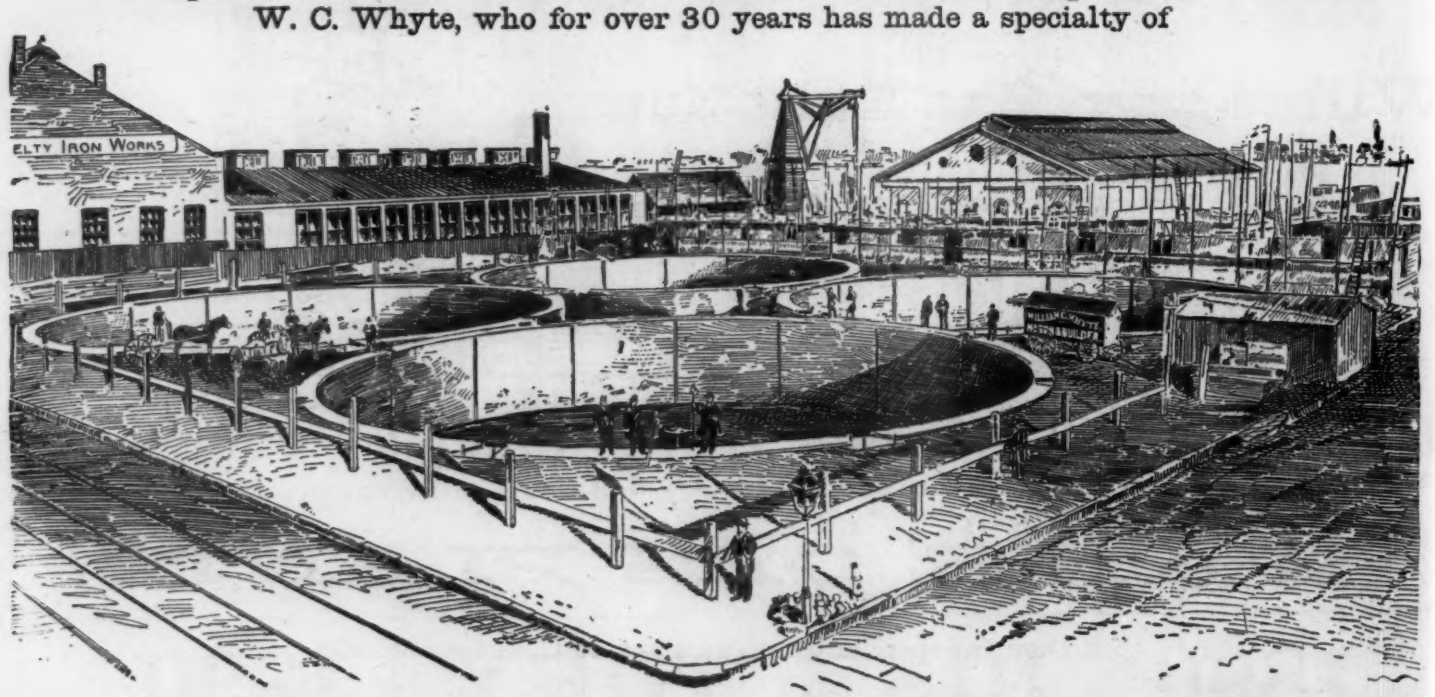

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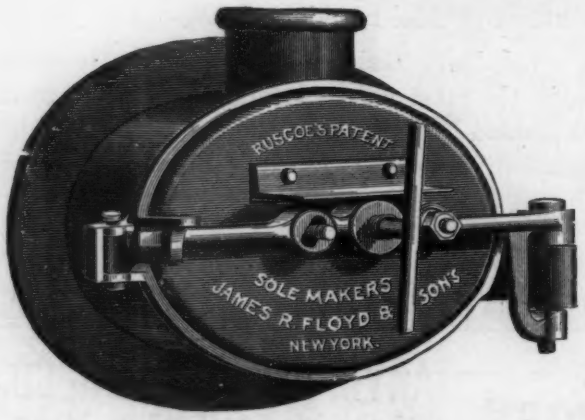

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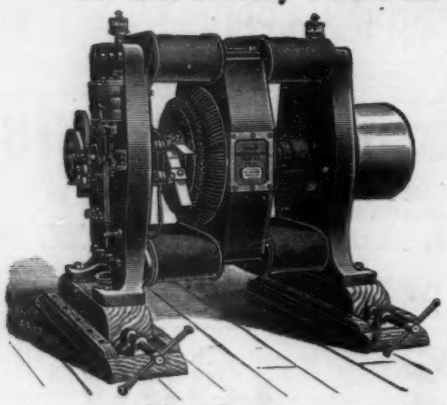

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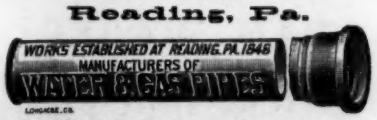

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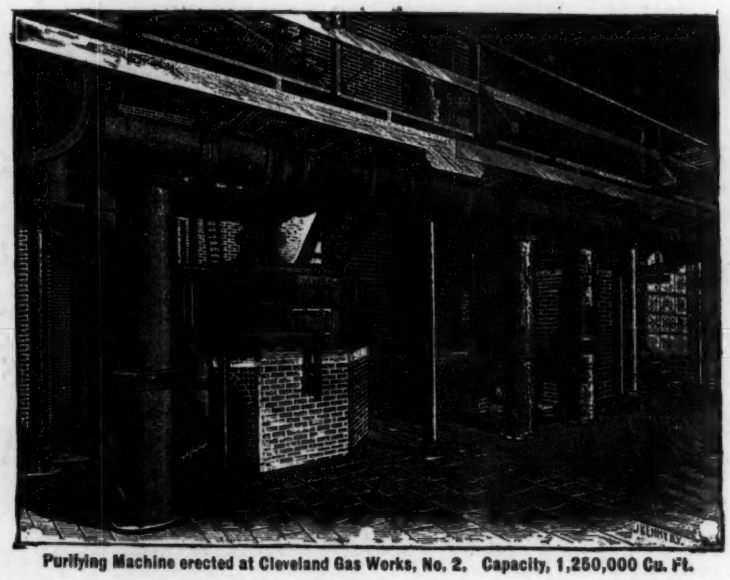

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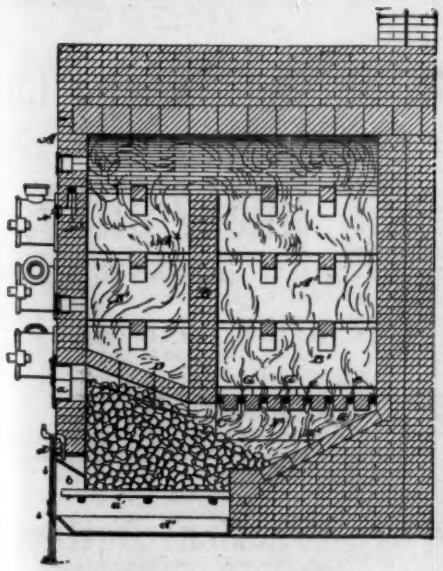

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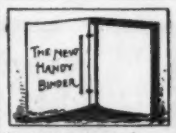

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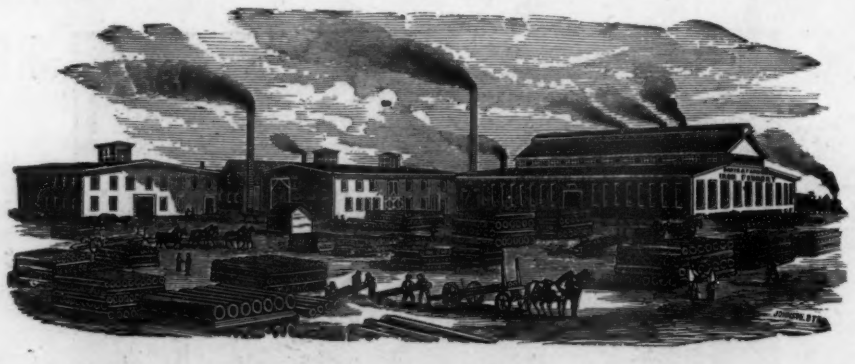

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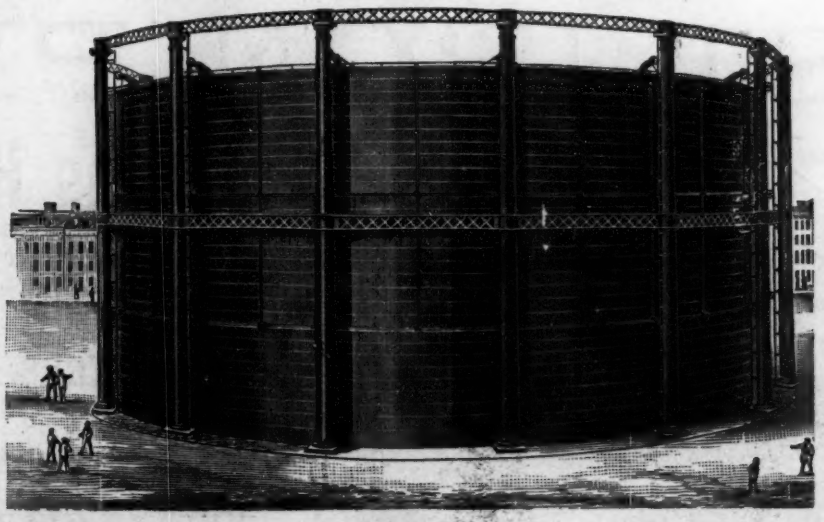

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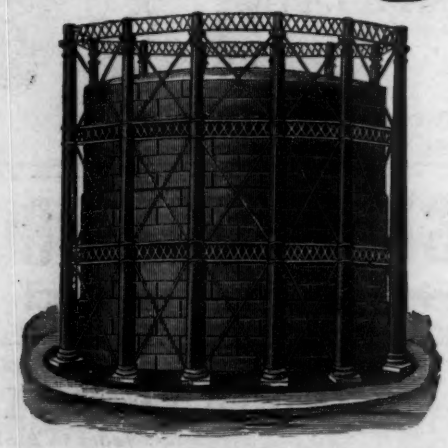

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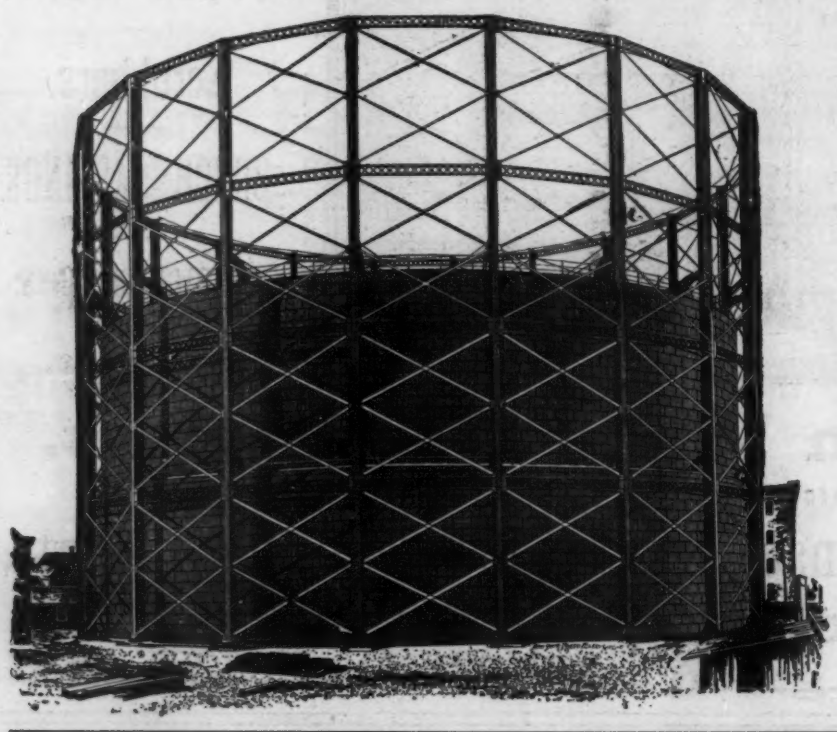

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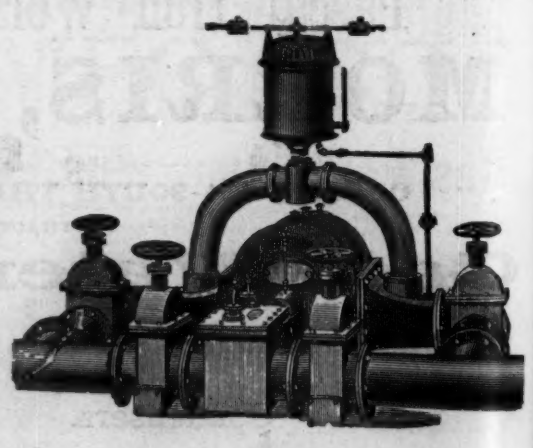

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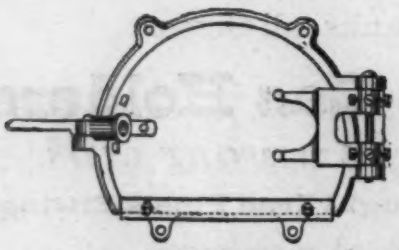

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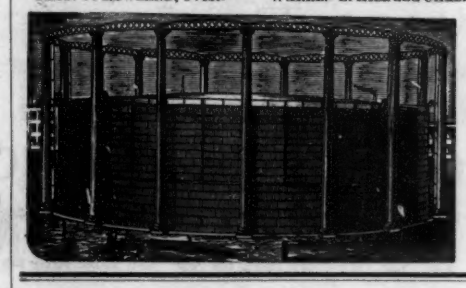
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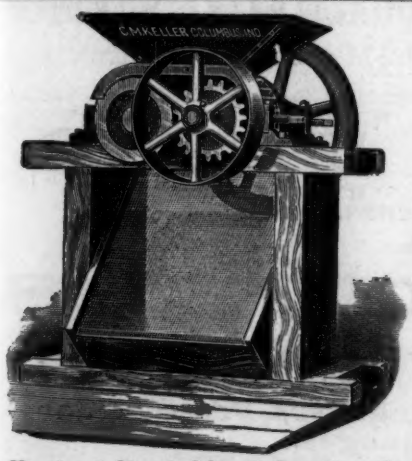

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The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

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High Pressure Meters for Natural Gas, in Iron Cases, guaranteed to stand 300 lbs. Pressure. Gas Cooking and Heating Stoves, Hot Plates, Cake Griddles, Waffle Bakers, Boiling Stoves, Laundry and Tailors' Iron Heaters. Hotel and Cafe Ranges a Specialty.

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Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

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We use only the very best materials, and employ the most skilled labor, and by our long experience (36 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

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The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	55 in.
20 in. wide.	17¼ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	33 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.